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Electrical World

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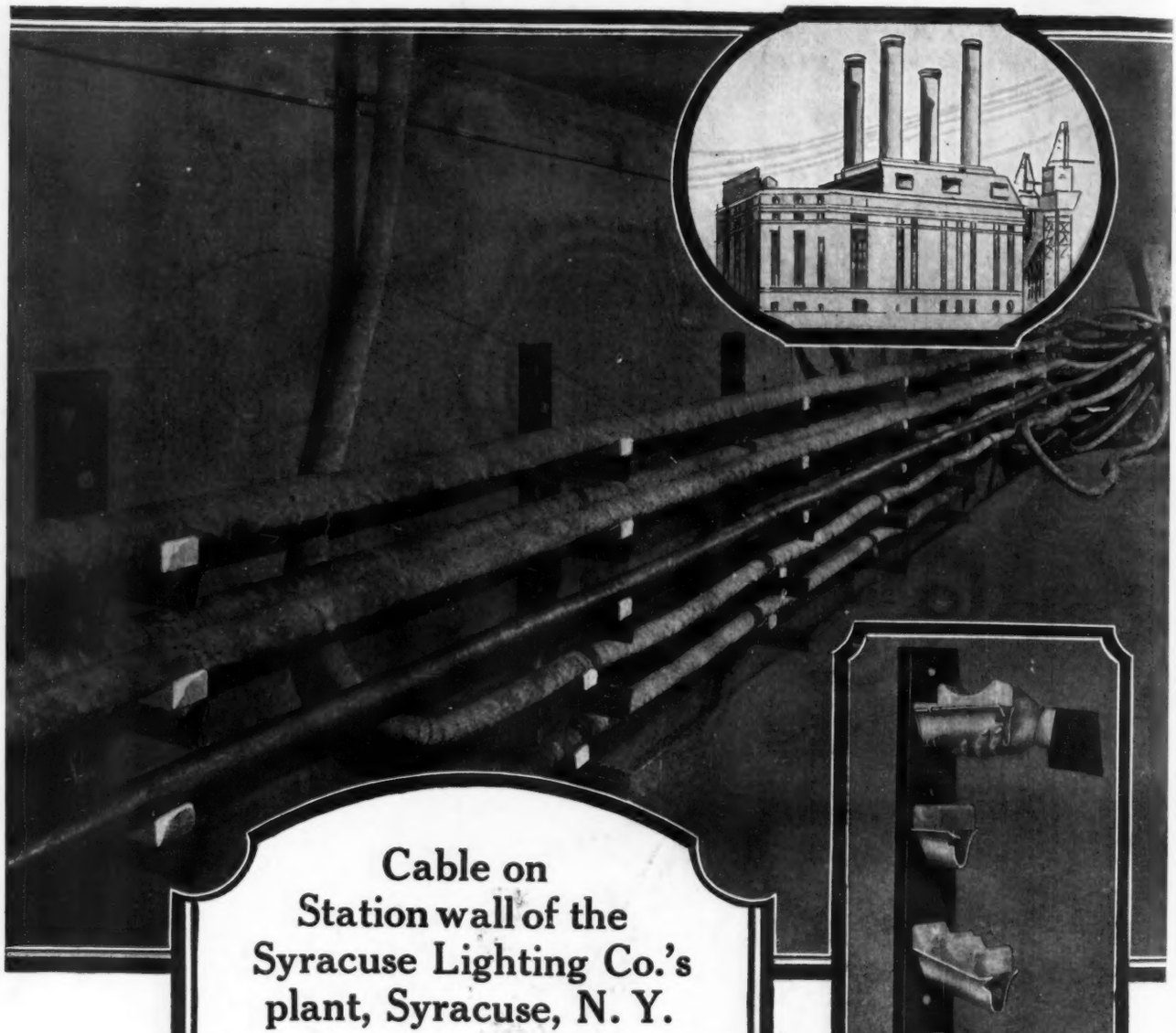

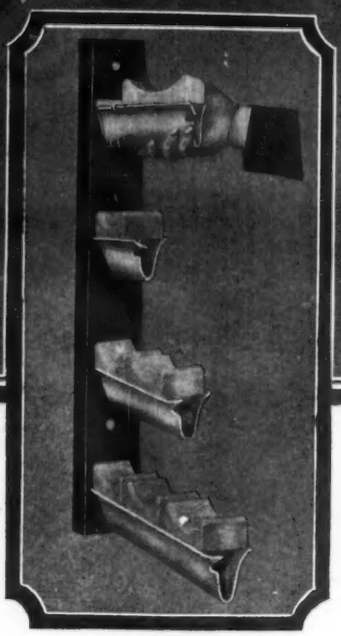

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 83 — New York, Saturday, May 17, 1924 — *Number* 20

Building for Future Stability

THE electrical industry owes much in its development to the individual pioneers whose aggressiveness and courage never failed when aggressiveness and courage were most needed. Fortunately—for the industry is still young—most of these men are still alive and still actively at work. And most of them have built, and still direct, strong and useful organizations in the industry. An occasional death in their ranks, an occurrence of regrettably and yet inevitably increasing frequency, usually brings still more clearly into light the strength and vision they have shown.

Of more value to the continued stability of the enterprises they have built than any other one thing is the fact that they have apparently realized the necessity of building their organizations so that, useful as they personally may be, necessary as they were to the building of the organizations, they can step out without impairing the essential, integral nature and continued constructive usefulness of that which they have created. The death last week of Henry M. Byllesby brings this fact most forcibly to attention, and it is indeed a tribute to Mr. Byllesby that his departure showed that he had thus prepared his organization to "carry on" without him. For years a small executive committee, of which he was a member, has directed the organization, with major responsibilities shifted to his associates. This is not a unique case in the electrical industry, nor is the electrical industry alone in the business world in the exercise of such foresight. But it augurs well for the future stability of the industry that the organizations in it are built and operated on such constructive lines.

Comparing Budgets with Expenses

AS THE practice of budgeting expenses grows more general among even the smaller utilities, the importance and value of regularly comparing estimated with actual outlays deserves wider recognition. President Samuel Ferguson of the New England Division, N. E. L. A., well said at a recent meeting of the Accounting Section that financial reports should include comparisons of operating figures with the estimates of cost prepared beforehand. Between the accounting and the operating departments in many companies there is a wide gulf fixed. Unnecessary rules and restraints exist regarding the use of material, and burdensome allocations of expense often create such a feeling of aloofness between departments that it is considered fair game to outwit the accountants. Where bogeys or estimates are set up and compared open-mindedly with expenses, to avoid waste of money without unduly hampering service and company development generally, great good can be realized through this co-operation. Operating and accounting departments should work together in comparing estimates with resulting costs, and a written report should be made upon every discrepancy of importance, promptly explaining any undue economy as well as any overrun. These departments will thus be brought closer together, and the comparisons will be worth far more than they can possibly cost in preparation and analysis.

Helping the Small-Plant Man

SOUTHWESTERN utility men have experienced the same difficulty which has arisen in other parts of the country in arranging programs and conducting meetings at large sectional conventions so that the "small-plant" men, as well as the "large-plant" men, shall be interested in the proceedings. They struck the solution to the problem at the recent joint convention in New Orleans of the Southwestern Public Service Association and Southwestern Division of the N. E. L. A. by devoting a special session, without parallel meetings, to the discussion of small-plant problems. This session was entirely separate from and followed the regular technical sessions. Small-plant men who attended it were so well pleased with the plan that a resolution was unanimously carried suggesting to the executive committee that arrangements be made another year for two sessions of this character in addition to the regular technical sessions.

Although the psychology of having a special session for small-plant men was largely responsible for more active participation by these men in this session than in the regular technical sessions, there is no question that the method of conducting the session had considerable influence and might be applied in all conventions more extensively than it has been. The plan involved the elimination of scheduled papers for presentation and the substitution of a few timely specific problems for general discussion led by one or two men who were known to have ideas on the subject. This apparently appeals to small-plant men; the formality of scheduling papers in advance seems to stifle discussion among them.

Evidently the poor success of the attempts heretofore made to draw these men out in regular technical sessions has been due to their belief that large companies are not interested in their detailed problems or that practices of large companies could not apply to the small ones. Those who attended the New Orleans small-plant session have, it is safe to say, changed their minds in part at least on these points. The real reason why technical sessions are not always a success is that the individual members of the association do not make it their duty to outline to their meetings and papers committee the specific subjects in which they are interested.

Until regular technical sessions can be so organized,

conducted and stimulated that small-plant and large-company men will be jointly interested in them the plan of the Southwestern utility men is strongly recommended to all associations as a path toward the desired goal, though here as elsewhere must be borne in mind the trite but truthful saying that one benefits only in proportion as he contributes.

The Electrical Industry an Industry of Records

RECORDS in the electric light and power industry are usually established only to be broken in a short time. Each year's accomplishment seems to be armor for next year's guns to pierce, and thus it goes. The history of our industry is one unbroken procession of records. Last fall transmission voltages jumped from 150,000 volts to 220,000 volts, and the new system worked well from the start. On December 18 the world's biggest waterwheel was started and its efficiency was remarkably high. Last Monday the largest single-cylinder steam turbine was put in operation and caused only a ripple in the day's news. There is no doubt that the public looks to the electrical industry to do great things. It accepts electrical achievements as a matter of course, and doubtless every citizen prides himself inwardly on his country's possession of so energetic, powerful and triumphant an industry. But, to borrow the lines of a celebrated actor, "You ain't seen nothing yet." The industry is only now beginning to get into its stride.

The Important Advantage of Machine Billing

THE influence of the purely business functions of a central-station company upon the profits, prosperity and progress of the institution and the service is something concerning which the industry is still acquiring many valuable facts. For instance, new and interesting evidence is accumulating as to the value and effect of the use of machines for handling customers' billing. Three points stand out particularly: (1) Machine billing reduces three accounting operations to one and brings a very important economy in labor. (2) It shortens materially the time required to get the bills into the customers' hands after the reading of the meter and, therefore, makes a direct saving in interest on more rapid collections. (3) It presents the statistical information on customer consumption each month with greater accuracy and as news rather than history, and it places the executive in more immediate touch with the condition of his business. The natural result is to quicken the entire process of customer accounting, and this, of course, has a direct bearing on public relations.

These are three important considerations. Multiply by the number of customers involved in the case of a large city and the totals become impressive. One company asserts that it saves about $50,000 a year this way. Another company now handles 300,000 customer accounts with 185 employees, whereas it used to need 195 employees to prepare by hand bills covering 200,000 accounts. The money value of more prompt statistical information and its effect on company policies and the indirect relation of it all to public relations are not so easy to set down in figures, but they must be considerable. Surely, there is nothing more irritating to the customer than a mistake in his bill, and there is nothing more enervating to the morale of an executive than to deal perpetually with post-mortem statistics and statements that do not tell exactly "how things are now."

Tremendous progress has been made in recent years in the development of mechanical accounting equipment that may be used to great advantage by the utility company. It is no whit less important to good management and to the profits of the enterprise than improved equipment in the station or on the lines. For a dollar saved in accounting is just as good as a dollar more squeezed out of the coal pile.

Overhead to Underground by Steps

AMERICAN cities are making appreciable strides toward civic beauty of a type found in the Latin countries of Europe. Good paving, center parkways, building zones, artistic street lighting are stimulating elements in this development and add effectiveness to the public-spirited endeavors of the increasing number of organized civic bodies.

It is both noteworthy and commendable that light and power companies are taking an active part in this work. In not a few localities they are the leaders and spend their money voluntarily to improve the appearance of the streets. But in many small cities strong pressure is put on the utility executives to make use of underground construction, in the business district at least, without taking account of the cost or advisability of an underground system. The object behind this pressure is, of course, to beautify the streets, and it is easy to sympathize with the desire, for too frequently an otherwise attractive business street is marred by a maze of overhead wires stretching in all directions from twisted, unsightly poles erected in poorly chosen places.

It will be readily admitted that public policy alone dictates that the utility should initiate the move toward a complete underground system whenever it is financially practicable. But in cases where analyses show prohibitive financial handicaps there are intermediate steps which may be taken and which may solve the problem of improving the appearance of streets very successfully at a small cost. For example, wooden poles can be carefully selected for appearance and their locations chosen with care. The use of steel poles, concrete poles or special structures may, however, be an advisable, though more expensive, step. Then it is astonishing how making only tangent and right-angle wire installations will enhance the aspect of a street, and very frequently this can be accomplished by the occasional use of rack structures on buildings along the street.

In one city effective results were obtained by locating primaries, and also transformers, on side streets and running only secondaries on the main streets. Services from the secondaries on rack construction were taken down through the tubular steel poles to a street manhole box and thence underground to the customers' premises. This type of construction lends itself to step-by-step growth toward a complete underground system. In another city concrete poles replaced wooden poles, and the overhead wiring was changed to tangent and right-angle construction with a very notable improvement in the appearance of the streets. In other

cities secondary racks were used extensively to get rid of cross-arms and reduce the congested appearance of the pole tops.

Thus there are available several methods of staving off a complete sub-surface system where expense makes it out of the question for the time being, and opportunity is offered many utilities to remove the pressure indefinitely by adopting an intermediate type of construction which costs little and lends itself ultimately to the all-underground installation.

A Tenth-of-a-Second World Too Small for Two Sets of Units

IT MAY not be generally known that there are two bills now pending in Congress relating to metric standards in the United States. One of these, numbered S100, has been introduced into the Senate by Mr. Ladd of North Dakota, and the other, numbered H.R.10, has been introduced into the House by Mr. Britten of Illinois. The two numbers are significant of the decimal relations to which the two bills refer. The text is identically the same in both bills. There are five sections, and only thirty-nine lines of text, in each. The bills provide that on and after January 1, 1932—i.e., about nine years hence—all commodities shall be bought and sold in the United States by and in terms of metric weights and measures, under the regulations of the Secretary of Commerce; also, that after the same date, all United States postage, excise duties and customs shall be charged or collected in metric terms. Goods may, however, be manufactured in any system of weights and measures.

This bill is introduced into Congress in response to a very widespread demand for reform in our American customary weights and measures. At present we have some forty-five units in our tables of such quantities, not decimally connected, and all, therefore, requiring to be memorized; although, as a matter of statistical inquiry, very few Americans actually carry all these tables in mind. The metric system, which is now either adopted or in course of being adopted by all the civilized countries of the world outside of the English-speaking countries, has only two units—the meter and the gram. If the liter, which is a cubic decimeter or 1,000 cubic centimeters, is considered to be a separate unit, by reason of its name, then there are three units in all.

All of the international electrical units are on a metric basis. The kilowatt and kilowatt-hour, for example, are already metric. The metric system is steadily extending its use in this country. It is asserted that more than a hundred thousand petitions are pending before Congress urging enactment of metric legislation and that many of these petitions are from organizations having, in the aggregate, hundreds of thousands of members.

From the standpoint of radio communication, this is a tenth-of-a-second world—no two persons being more remote from each other than a tenth of a second in time—and it seems that a tenth-of-a-second world is too small to maintain more than one system of weights and measures. As a matter of fact, about thirty countries have already adopted the two-unit metric system, and many of these did so long ago. None has ever reverted to its pre-existing system. But the English-speaking countries still hold to a forty-five-unit system, and of these units about eighteen are different in the corresponding English and American systems! In order to effect international unification, it is hopeless to expect the thirty other countries to come over to us, and it is morally certain that we shall have to join the thirty. The only question is when.

According to the history books, it required about one hundred and fifty years for the simple international Arabic numerals to displace the complicated Roman numerals in accounts and in general business. Only this year has the Gregorian calendar, or new style in the marking of dates, completely displaced the Julian calendar, or old style. On that matter eastern Europe has just come into line with the rest of the world. The change was brought into effect in Europe in 1582, but it was not adopted in England and in America until 1752—a hundred and seventy years later. Washington's Birthday is universally celebrated on February 22, but at the date of his birth (1732) his birthday was Julian and occurred on February 11.

The Britten-Ladd bill as a measure for introducing the metric system offers the following advantages: It is a very simple bill to comprehend and employs less than three hundred words in its text. It gives nearly nine years' notice in advance of the change. It explicitly does not require any manufacturer to change any of the parts which he constructs.

A large number of readers, already cognizant of the advantages of the metric system through the use of electrical units, are sure to favor the bill. When the members of the American Institute of Electrical Engineers were canvassed by circular a number of years ago on the subject of the metric system, a large majority expressed themselves as favoring such national legislation as would bring about the change with the minimum trouble and expense.

The bill merits support.

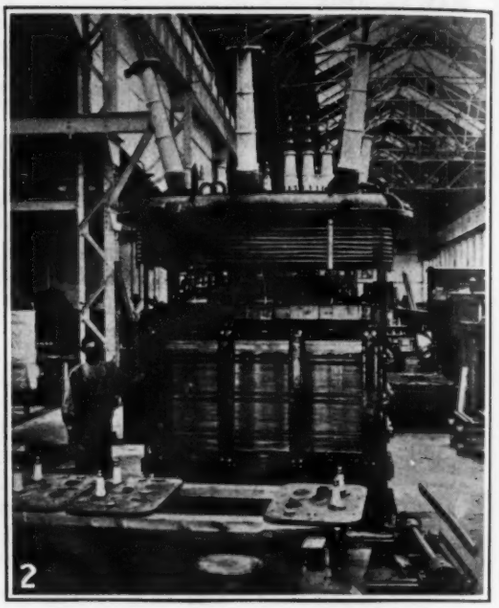
A Change from "Up to Him" to "Up to Us"

AN INDUSTRIAL customer had some trouble with his motors. At a conference at which several members of the staff of the local power company were present the manager of this company said: "Well, it is up to us fellows to see that his plant shall run O. K." A middle-aged man who was present remarked afterward: "What a change compared with the attitude of ten or fifteen years ago! The former manager would have probably said: 'If his motors are no good, it is up to him,' meaning the customer himself."

This change from an "up-to-him" attitude to one of "up to me" or "up to us" is distinctly noticeable throughout the industry in all its branches. The manufacturer co-operates with the dealer and the customer and does not attempt to split hairs on moot points; the operating man helps his clientèle and the city and takes even undeserved blame in good grace; the teacher studies the vital problems of the industry and guides future engineers accordingly. There is an atmosphere of good will and a clearer understanding of one another's needs and of the fact that there is no "him" or "me," but only "us"; that all are actors in the same big pageant, and that it is the "ensemble" that counts and not the trick of overshadowing some fellow-actor. All these signs of the times vouchsafe a healthy growth of our industry in prosperous times and a manly strength in days of adversity.

Interesting Swedish Rural Line Practices

RURAL lines have been developed extensively in Sweden and in Fig. 1 is shown the typical construction used, while Figs. 5, 6 and 7 show details of installation. In Fig. 2 is shown a regulating tap transformer for 70,000, 20,000 and 6,000 volts. The taps are brought out in concentric bushings, as indicated in Fig. 3, and give the three winding transformers adaptability to changing load conditions. Oil break disconnecting switches are used to connect the transformers to the 77,000-volt bus, but oil breakers are used on outgoing lines (Fig. 4) from the low-tension side of the banks.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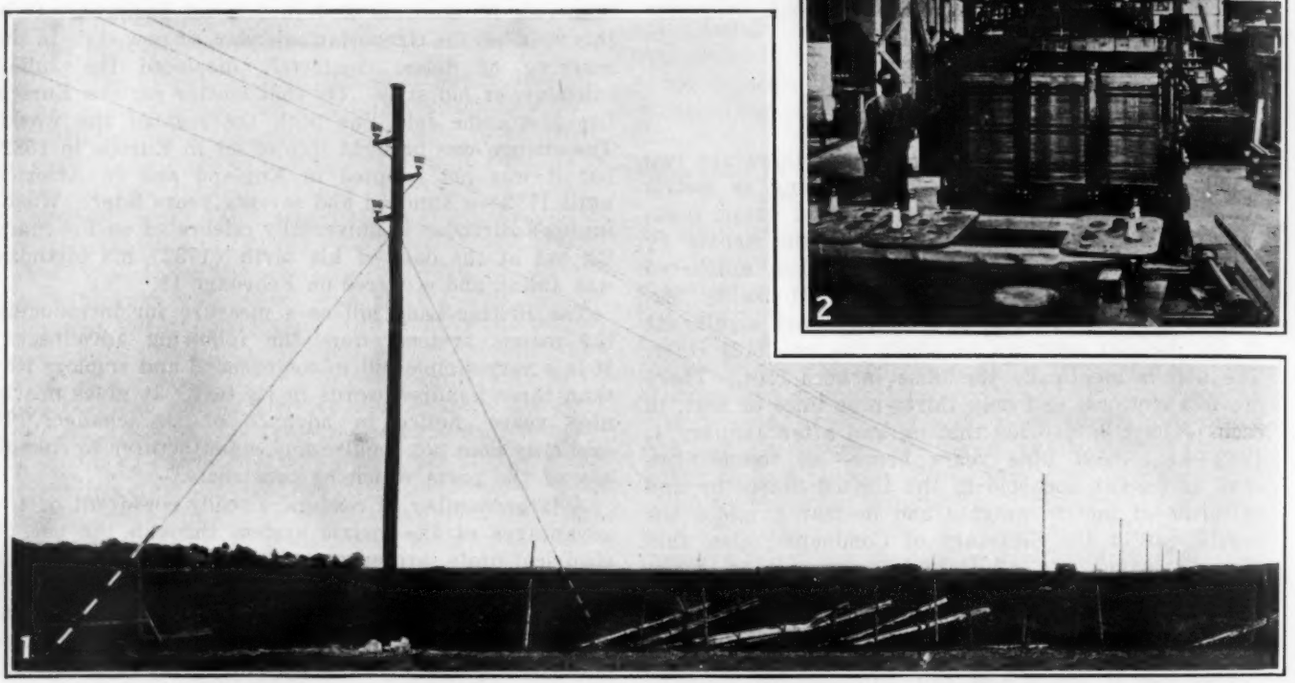
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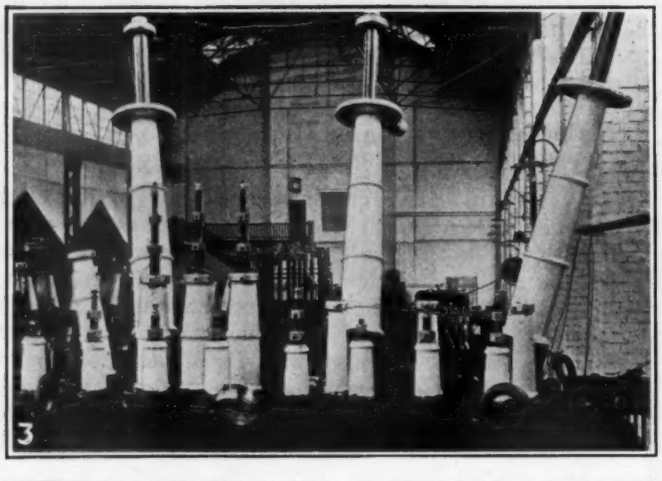
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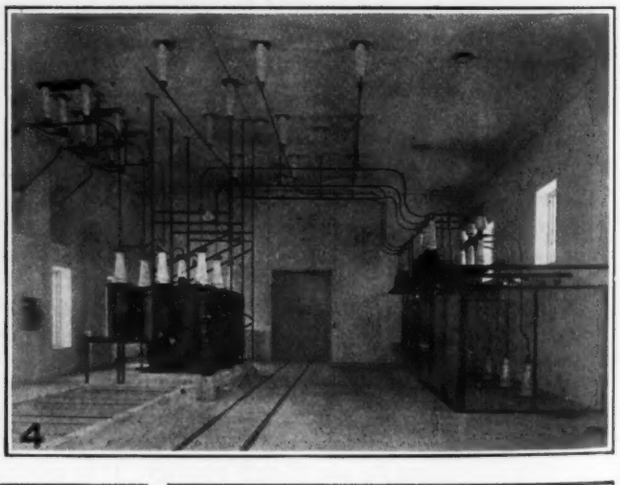
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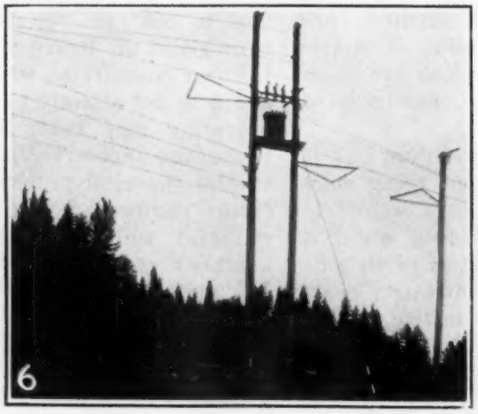
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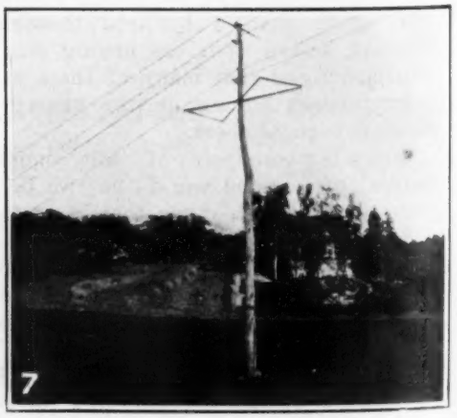
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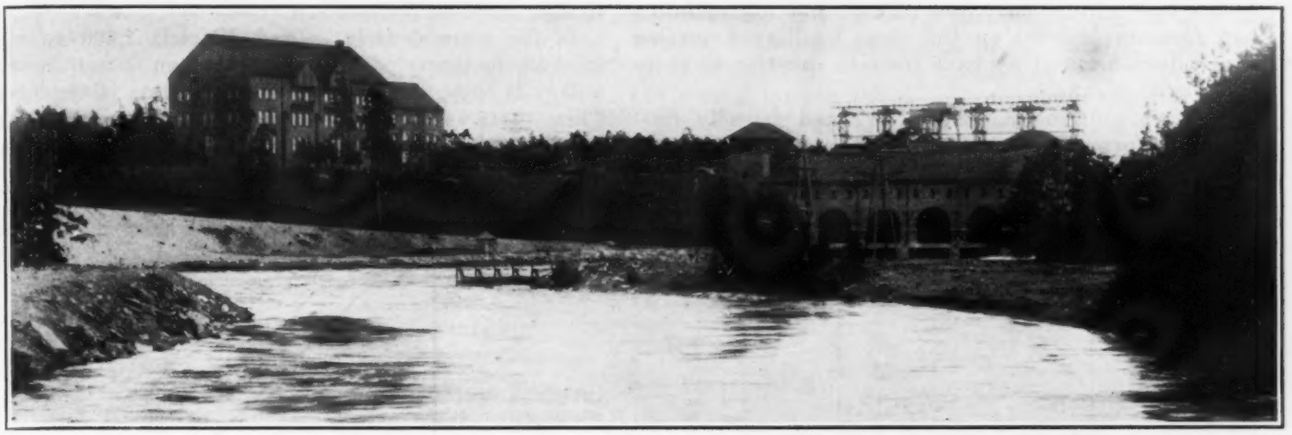
Swedish Water Power and the Farmer

Forty per Cent of Tilled Land Now Within Reach of Electric Transmission Lines — Standardized Distribution System Employed, Which Is Partly Financed by Farmers' Local Co-operative Societies



STATE-OWNED HYDRO-ELECTRIC STATION AT ALVKARLEBY, SWEDEN. THIS STATION SUPPLIES 1,500,000 ACRES OF TILLED LAND WITH ELECTRICITY

THERE are now about 3,800,000 hectares (9,500,000 acres) of land under cultivation in Sweden, 40 per cent of which, or about 1,500,000 hectares (3,700,000 acres), is within reach of electric transmission lines, so that not only country villages but virtually every farmer and craftsman within this electrified district can obtain electricity.

Recent estimates made by the Royal Electrification Commission of Sweden indicate that there are 250,000,000 Swedish crowns invested in generator and transformer stations and transmission lines for rural electrification, and another 60,000,000 crowns is represented in the individual rural power consumers' installations. Based on 1914 prices, this gives an aggregate investment of about 200,000,000 crowns ($53,000,000), or about 133 crowns per hectare ($25 per acre). In these figures are included the electric supply systems for smaller townships and rural municipalities and for small industries such as carpenter shops, brick yards, etc.

An estimate of the grand total invested in electrical plants, including all industries, mines, electrified railroads and rural distribution systems, gives a pre-war value of between 450,000,000 and 500,000,000 Swedish crowns ($119,000,000 to $132,000,000). A comparison of these figures with the capital already invested in purely rural electrification systems shows the relatively great importance from an investment point of view of rural electrification in Sweden.

The energy consumption in the rural districts, however, is not so large proportionately as the investment. Rural consumption at the generating station averages between 60 kw.-hr. and 70 kw.-hr. per hectare (30 kw.-hr. per acre) of tilled ground, although the actual energy consumption at the farm itself ranges from 30 kw.-hr. to 40 kw.-hr. per hectare (12 kw.-hr. to 16 kw.-hr. per acre), the difference representing losses in transmission. Allowing only 10 per cent for capital, maintenance and operation, the annual outlay on the 250,000,000 crowns invested would be 25,000,000 crowns for approximately 60,000,000 kw.-hr. a year, which corresponds to 43 öre, or about 11 cents a kilowatt-hour. In regions where during the war local distribution systems were put up rather recklessly the cost exceeds this average, but inasmuch as the consumption of electricity increases with time, in many districts where there is a systematic and carefully organized plan of electrification, the cost of energy is not so high as 11 cents.

State Power System Supplies One-Third the Electrified Rural Districts

Rural electrification has been developed in Sweden by many different agencies. Manufacturers with water-power plants of their own often found it advantageous to make power contracts with neighboring villages and farms when changing over to electric drive. Co-operative societies were also formed by farmers for the purpose of utilizing electricity from some near-by water-power site. The bulk of the business, however, has been built up by the larger power companies. The state-owned system in central Sweden supplies electricity to about one-third of the total electrified rural area. In southern Sweden the Hensjö and Finsjö power companies, now a part of the South Swedish Power Company, have developed extensive rural systems, while in other parts of the country the Yngeredsfors Gullspang-Munkfors, Rimfors, Svartadalens, Linköping, Smaland and a great number of other private power companies are supplying groups of rural consumers.

At first many of the privately owned power companies were short-sighted enough to pick out only the economically best rural loads, ignoring scores of possible consumers. This policy was subsequently found to be not the best, since any rural electrification scheme to be economically successful should include every farm, or almost every farm, on the same conditions. Experi-

ence in Sweden has shown that unless all the consumers are brought together from the very start and directly interested in the enterprise rural electrification plans are likely to fail. It has also been found necessary in Sweden to employ a satisfactory but less expensive type of overhead-line construction on rural lines. Moreover, electrification of rural districts with the population density common in Sweden—twenty to thirty inhabitants per square kilometer, or fifty to eighty per square mile—would have been an economic impossibility had farmers insisted on the same quality of service which dwellers in cities have come to consider as their undeniable right.

Through untiring publicity work and friendly contact, the farmers in Sweden have accepted the idea that it is better for them to show a reasonable tolerance in the matter of service interruptions and voltage regulation, and thus be assured of fairly decent central-station service at reasonable cost, than to insist on a service that could be rendered only at prohibitive rates, if it were made available at all. The Swedish farmer is usually so appreciative of electric service that he does not take unkindly to the use of a kerosene-oil lamp in a pinch or to an interruption of an hour or two in service during threshing time. Farming districts therefore are usually supplied from single lines of simple and cheap construction; reserve equipment is kept down to very moderate cost, and the number of inspectors and troublemen is a minimum.

Extensive researches by the Royal Board of Waterfalls of Sweden have shown that in evenly settled districts economical distribution is obtained by using an intermediate system of feeder lines as follows: From main high-tension substations, 20,000-volt feeders reach out to rural substations systematically scattered throughout the district. From these rural substations energy is distributed at 3,000 volts to the individual farms, where it is further stepped down to 220 volts or 380 volts.

In the more densely settled districts 1,500 volts is used on the intermediate lines, and if an out-of-the-way village is to be picked up, a 6,000-volt line is employed. This three-voltage system is used throughout the greater part of central Sweden, and in southern Sweden the Hemsjö company has worked out a rather similar scheme, although with rural extension lines of 10,000 volts to substations and 1,500 volts to individual farms.

In northern Sweden, where the settlements form narrow strips along the valleys of the big rivers, and in many other regions where farm loads are big but far apart, high-tension feeders are directly tapped from the rural extensions, which are usually operated at 10,000 volts. In such cases the region around each local transformer is usually supplied at 380 volts, sometimes at 500 volts, with special 110-volt lamp transformers.

The use of an intermediate distribution voltage, it is claimed, offers many advantages which justify the complication not only from an economic standpoint but

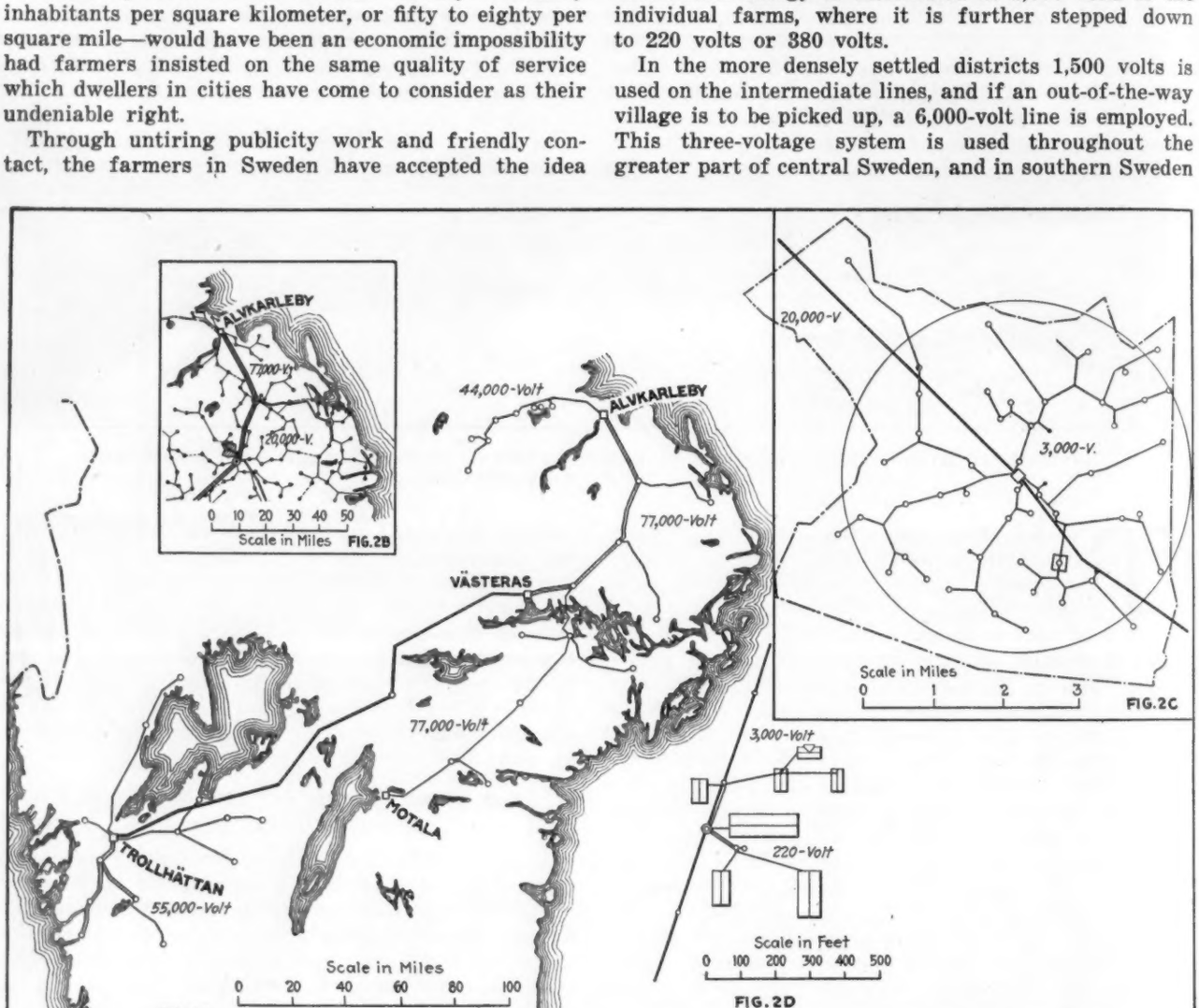


FIG. 2—STATE POWER SYSTEMS ARE TIED TOGETHER BY A TRUNK LINE BETWEEN TROLLHÄTTAN AND VÄSTERAS

(a) General system, showing 132,000-volt trunk line. (b) Part of system north of Stockholm in greater detail. (c) Part of system depicted in (b) on a larger scale, showing 20,000-volt lines at 3,000 volts. (d) Part of system depicted in (c) on larger scale, showing 3,000-volt line and secondary 220-volt distribution to farms.

also by limiting disturbances in the local systems to smaller areas and by making it feasible to use 220 volts for the farm systems, thus decreasing the hazard of accidents always present with 380 volts when inexperienced people have to handle electrical appliances. The three-voltage system also forms an excellent basis for bringing local interests in the district within reach of each rural substation and enables the farmers in each of these districts to form a co-operative distribution society after the plan adopted by the state-owned system. These co-operative societies purchase 3,000-volt energy in bulk at the rural substations and distribute it to members and to other consumers in the district. By such an arrangement the utility company is relieved of a lot of minor troubles and questions regarding the local service which are better settled among the consumers themselves. Maximum flexibility is also obtained, each distribution society automatically adapting its local conditions to meet the requirements, financial, geographic and psychological, of the particular group of farmers constituting the society.

Typical Rural Distribution System

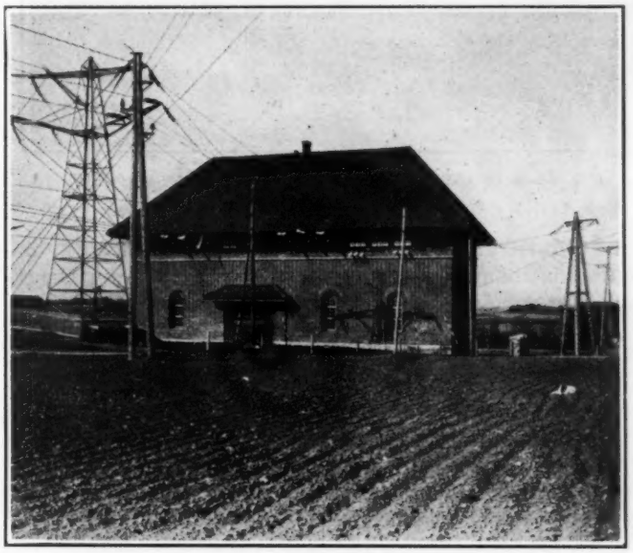
The state power system in central Sweden is supplied from water-power stations at Trollhättan (115,000 kw.) and Alvkarleby (55,000 kw.), which co-operate with a hydro-electric peak plant at Motala (10,000 kw.) and a steam reserve and synchronous condenser station at Västeras (40,000 kw.). From the power stations primary high-tension transmission lines of 55,000 volts and 77,000 volts radiate, while the eastern and western systems are tied together by a 132,000-volt trunk line between Trollhättan and Västeras, as shown on the map, Fig. 2a. No less than 11 per cent of the aggregate rating of power-consuming equipment connected to this system is scattered throughout rural districts, although the rural energy consumption is only between 3 and 4 per cent of the total.

Fig. 2b shows in greater detail a part of the region north of Stockholm, which has been uniformly and systematically developed. This area is supplied from the Alvkarleby power station. The backbone of the Alvkarleby primary system is a two-circuit steel-tower line for 77,000 volts, drawn on the map as a heavy double line. Outlying load centers are supplied over interurban single-circuit branch lines on wooden poles. These branch lines sometimes are provided with a fourth conductor as reserve to enable conductors and insulators to be changed without service interruption and to limit the duration of outages due to line faults.

Transformers with Multiple Taps Make System Flexible

The distance between secondary substations usually is about 25 miles, but the area supplied from these stations, as rural extension centers, is a circle with a radius of 25 miles. The substations preferably are located in the immediate neighborhood of important municipal or industrial power consumers and sell a good deal of power directly at lower voltages. The step-down transformers, which have a rating of from 2,000 kva. to 6,000 kva., therefore often are provided with two separate secondary windings, one for 20,000 volts, supplying the rural extension lines or secondary lines, and another for 6,000 volts or 3,000 volts, for direct service to bigger consumers in the neighborhood. While the 70,000-volt and 20,000-volt windings generally are star-connected, the third winding often is connected in delta, or else the transformer has a fourth winding, consisting of one turn of a short-circuited delta-connected heavy copper strip, to prevent telephone disturbances from the 20,000-volt neutral, which is usually grounded through a resistance or a grounding reactor.

The prevailing mixture of industrial, municipal and rural load has made it necessary to give close attention to voltage regulation. The primary voltage in substations is kept fairly constant by running the turbo-generators of the reserve plant at Västeras as synchronous condensers, and a cheap and effective method of making the voltage conditions in the rural extension systems sufficiently flexible has been found by bringing out several taps on the secondary side of the step-down transformers. Such a transformer, therefore, often has separate taps in all three phases, for 20,000, 21,000, 22,000 and 23,000 volts.



SUBSTATION ON SWEDISH STATE-OWNED SYSTEM

To the left is the double-circuit steel-tower line. On the right branches off a less important 77,000-volt line on wooden poles, and in front two 20,000-volt secondary lines run to small substations in rural districts.

The regulation taps are brought out from the transformer tank through concentric bushings, as shown in Fig. 3, which gives a view of the top of one of the transformers. The three bushings at the left, with four taps each, contain the four regulating taps of the 20,000-volt winding. The adjustable taps usually are connected at the neutral and thus may be closer spaced than the three 20,000-volt phase bushings, which may be seen on the right. The front row of bushings belong to the third winding, for 6,000 volts, which in this case was no less than five regulating taps divided upon duplex and triplex bushings, one corner of the delta coming out in a single bushing.

In order to give the transformer still more flexibility, a 7 per cent tap brought out on the high-tension side is connected to the static screens on the big 70,000-volt bushings. The medium-sized bushing on the extreme left is the high-tension neutral.

In some secondary stations motor-operated tap-changing devices are installed, which are somewhat similar to the storage-battery cell regulator, so that the ratio of transformation can be changed with full load on. In other stations the taps are shifted only twice a week, special Sunday connections being used from 1

FIG. 8—A QUARTERNARY SUBSTATION WHICH SUPPLIES SEVERAL ADJOINING FARMS

p.m. Saturday to Monday noon. The tap schedule, of course, is changed according to seasonal load variations and also varies from year to year as the load grows.

Where a particularly large industrial day load is carried by the substation, special transformers having a fixed ratio chosen to fit average work-day conditions are provided for day service. Individual transformers in a bank sometimes have oil switches only on the low side, while the expensive 77,000-volt circuit breakers are replaced by oil-break disconnecting switches of the type shown in Fig. 4.

EACH SECONDARY SUBSTATION FEEDS TWENTY TERTIARY SUBSTATIONS

From the 20,000-volt busbars of the secondary substations three to six secondary lines run out to smaller substations systematically scattered throughout the surrounding rural districts. These rural extensions are carried on simple wooden poles, with pin-type insulators and copper conductors from 10 sq.mm. to 35 sq.mm. (20,000 circ.mil to 70,000 circ,mil). The average span is 80 m. (260 ft.), and every fifth pole is a strain pole with guys and reinforced cross-arms.

Normally there are a great many outgoing branches to each secondary line, and the mileage per line in certain cases approaches 100. Each line has an oil circuit breaker and two overload relays, while a third relay connected in the common return to the three current transformers acts as a cut-out in case of faults or grounds. In several stations, Petersen earth coils have been installed in the 20,000-volt neutrals. The ground reactor has a secondary winding for 110 volts, feeding an alarm bell acting as a ground fault signal. The Petersen coil has been found to quench accidental arcs very effectively. In particularly severe cases of permanent arcing ground the substation attendant throws in an 800-ohm to 1,000-ohm resistance in parallel with the ground coil, thus permitting the balance relay to disconnect the faulty line. Where this system has been installed the frequency of accidental kick-offs on the secondary lines has been reduced to less than one-tenth.

Tertiary substations consist of small brick buildings and are equipped with one or more 50-kva. to 300-kva. transformers. Like the secondary transformers, these tertiary ones are provided with three or four voltage taps on the low side. These taps often are changed in the fall to compensate for the voltage drop caused by the heavy motor load experienced during threshing time.

The transformers are Y/Y-connected, and the 3,000-volt neutral is grounded through a voltage transformer, which in reality acts very much like a Petersen grounding coil. The secondary winding of the grounding transformer is connected to a large electric horn fastened to the outside of the station building. In case of a ground fault the horn operates automatically and can be heard four or five hundred meters away. Usually arrangements are made with some person living close to the substation to hunt up more obvious faults or else notify the power company on the telephone.

TERTIARY LINE FUSES ACCESSIBLE FROM THE OUTSIDE

The tertiary transformers are protected by oil-filled fuses on the high side, except for certain larger stations, where oil breakers are used. The outgoing 3,000-volt lines are equipped with porcelain safety fuses. Since the local distribution society itself owns and operates the tertiary system, the society electrician must have access to the line fuses, but for obvious reasons he must not be allowed to tamper with the transformers and other equipment.

For this purpose the line fuses are arranged in compartments in the station wall, which may be opened from the outside with a patent key. Fig. 9 shows an arrangement whereby the line is automatically disconnected and grounded when the compartment is opened, and Fig. 10 is a close-up view of a station with three compartments, the middle one being open, so that the fuses are visible and can be reached from the outside. The doors of the compartment are connected to ground. Sometimes it is very difficult to obtain a reliable ground connection, and, particularly when a ground fault develops, the grounding plate sometimes has a tendency to dry out. To prevent the attendant from getting shocks from the door or fuse clips a small platform is provided outside and supported by ordinary busbar insulators.

In larger substations the doors are placed in an iron grating, which divides the station in two parts, the society's troublemen having access to the outer compartment, while the transformers and all live parts are inaccessible to any but central-station inspectors. The fuses are provided with metal arc deflectors to prevent the arc from jumping to the grounded iron and thus causing a short circuit which would blow the main 20,000-volt transformer fuses.

There are from five to ten tertiary substations on each secondary line. The economic radius of action

TABLE I—RURAL TRANSMISSION AND DISTRIBUTION DATA

The figures are for the complete electrification of a district containing 1,000,000 acres of tilled ground.

Equipment	Number of Stations	Mileage of Lines	Cost per Station	Cost per Mile	Total
20,000-volt rural extensions	.....	1,400	.....	$1,700	$2,400,000
Rural substations	230	.....	$4,500	.....	1,000,000
3,000-volt high-tension distribution lines	.....	4,500	.....	700	3,100,000
Local substations	5,500	.....	175	.....	1,000,000
220-volt local distribution lines	.....	1,700	500	.....	800,000
Meter stations	20,000	.....	20	.....	400,000
Total investment					$8,750,000

of a tertiary station with 3,000 volts on the low side of the transformers is from 4 km. to 6 km. (2.5 miles to 4 miles), but varies a good deal, depending on the character and spacing of the forms. The small shaded area in Fig. 2b is the local district supplied by one tertiary station. The same area is shown on an enlarged scale in Fig. 2c. The limits of such a local high-tension distribution district, although approximately determined by the economic radius of the station, for practical reasons usually conform rather closely with parish borders.

Within the district shown in Fig. 2c there is about 60 km. (40 miles) of 3,000-volt tertiary lines for high-tension distribution to fifty-odd farm stations or quarternary stations. These figures are rather above the averages, which run about 34 km. (21 miles) of tertiary line and twenty to forty farm stations to each rural substation. The farm stations usually consist of a small transformer of from 2 kva. to 15 kva. capacity, mounted between two poles and provided with necessary fuses and disconnecting switches. Sometimes several farms are supplied from one large transformer, which in that case is usually placed in a wooden structure, serving as a quarternary substation and a center for 220-volt or 380-volt distribution and for metering. From this center distribution lines run out to the different houses.

INVESTMENT IN RURAL SYSTEM ABOUT $9 AN ACRE

In the regions supplied by the Alvkarleby rural distribution system there live approximately fifty to sixty inhabitants per square mile, and the cultivated ground is about 2.5 acres per inhabitant, or, in other words, about 30 per cent of the total land area is cultivated. The farms are rather small, only one in twenty exceeding 225 acres of tilled ground, but these bigger farms aggregate about one-third of the arable land. As mentioned before, the average energy consumption is about 16 kw.-hr. per acre a year. The power-consuming

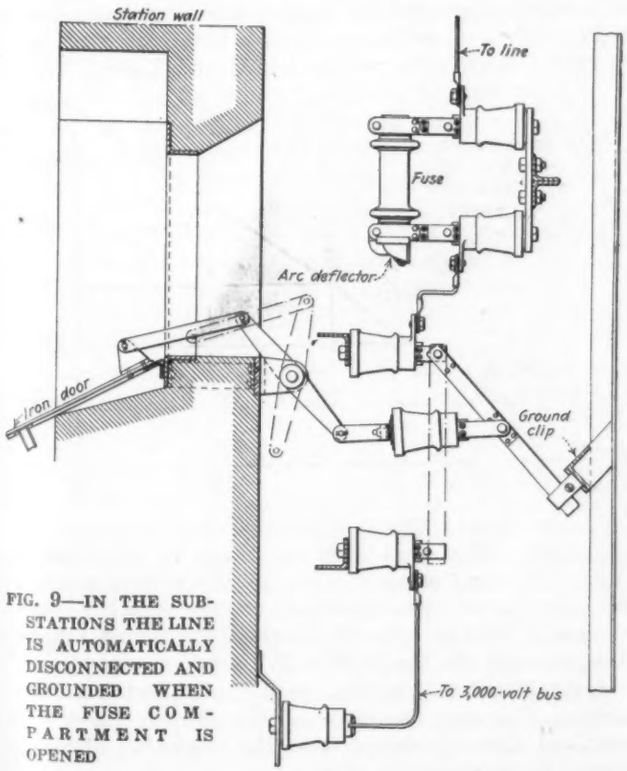


FIG. 9—IN THE SUBSTATIONS THE LINE IS AUTOMATICALLY DISCONNECTED AND GROUNDED WHEN THE FUSE COMPARTMENT IS OPENED

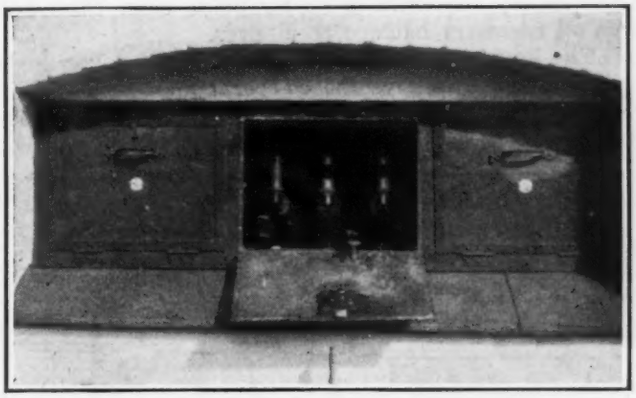


FIG. 10—A CLOSE-UP OF A FUSE COMPARTMENT IN A SUBSTATION

apparatus averages about 150 watts per acre, corresponding to a load factor of roughly 12 per cent.

Under these conditions the cost of equipment needed for transmitting and distributing electric power from the secondary substation to the 220-volt meters in the farmhouses over a district with 1,000,000 acres of tilled ground will be approximately as shown in Table I.

The table is based upon official statistics from the Swedish state power system and on certain average cost and equipment data for local systems belonging to cooperative societies in the Alvkarleby district. The figures naturally give only approximative averages. They are intended to show how, in an actual example, the investment divides itself upon the consecutive links of the transmission and distribution system and to give an idea of the total cost per acre, based on market conditions of today. In the region referred to the rural lines and substations are not yet fully utilized. Nor are the local systems yet fully developed. It is therefore to be expected, with a 100 per cent electrification, that the first two items will be lower and the last three higher than the table shows.

With a 12 per cent allowance for depreciation, return on investment, etc., the yearly cost would be $1,050,000 for 16,000,000 kw.-hr., which gives a transmission cost of 6.6 cents per kilowatt-hour. Assuming an energy rate of 1.5 cents per kilowatt-hour at the substation and 50 per cent losses, the total energy cost then would be around 10 cents per kilowatt-hour, which checks reasonably well with actual figures.

The distribution societies usually have between 50,000 and 100,000 crowns ($13,000 to $25,000) invested in their distribution systems. The economic interest is divided in proportion to the number of shares, each share corresponding to one hectare of tilled ground, or two lamps, for non-farming members. The number of shares is about 1,500 to 2,500, and in the Alvkarleby region there are usually from forty to fifty shareholders to each distribution society. In other parts of the country the number of society members may reach 150 or 200.

The capital usually is obtained from some local savings bank or other credit institution through mortgages on the society members' farms. Some time ago a law was passed permitting mortgages to be placed on transmission lines and electric equipment, so as to make it easier for the societies to finance their system, but this provision has not been used much so far, bankers showing little interest in securities of this kind. In order to keep down the actual out-of-pocket cash required

the society shareholders supply poles, erect them and do all necessary haulage themselves.

The Royal Board of Waterfalls of Sweden has made it a principle to give the co-operative societies every assistance. Specifications for local systems, bookkeeping instructions, standard sets of society bylaws,

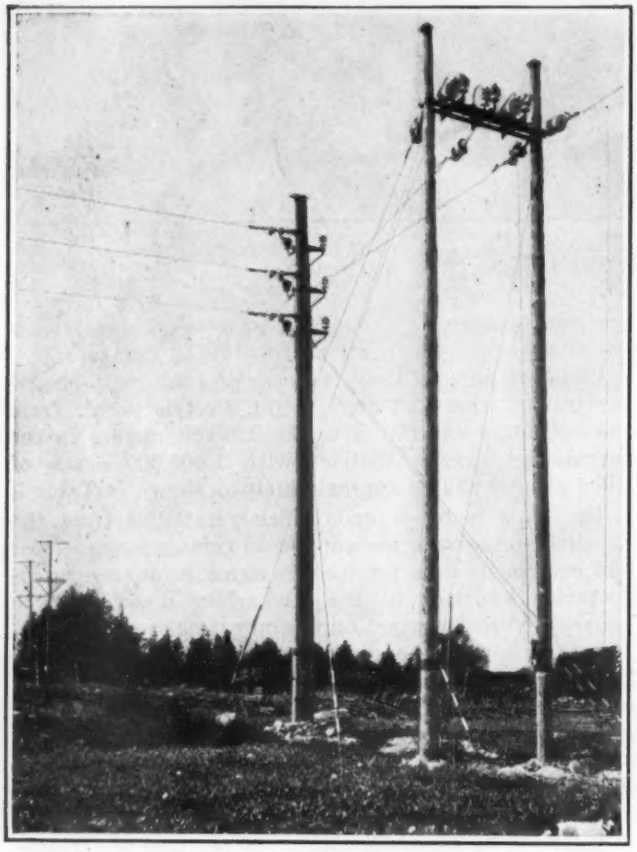


FIG. 11—SECTIONALIZING SWITCHES ARE PLACED AT INTERVALS ON THE RURAL EXTENSION LINES

billing forms, etc., are furnished to the societies at cost. Complete descriptions and drawings of systems planned must be filed with the board before any work is started. This rule in reality gives the distribution society the advantage of free consulting service of the highest class. In regions outside the state system special county officials act as consulting agents, aiding and coordinating society activities and supervising construction work. The creation of a national consulting bureau under the Department of Agriculture is contemplated.

ENERGY CONSUMPTION STIMULATED BY NEW RATE SCHEDULE

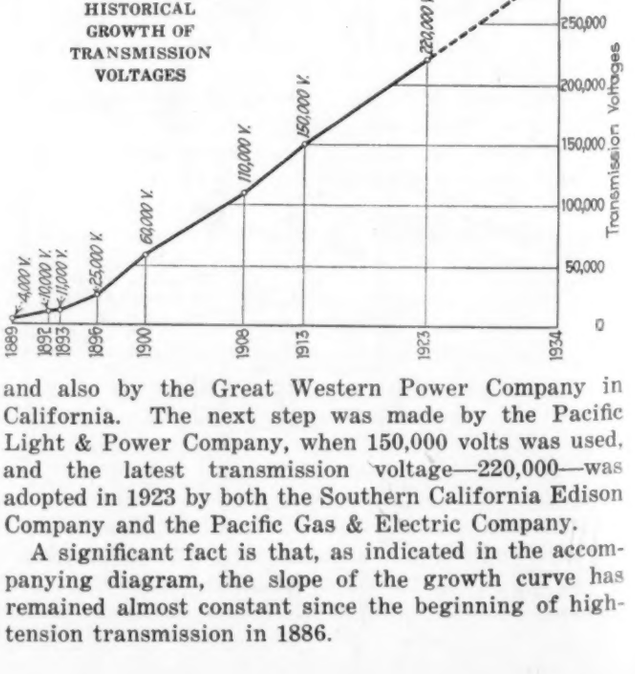
Hitherto distribution societies supplied from the state system have paid a flat energy rate of 10 öre (2.7 cents) per kilowatt-hour, with a rate of 25 öre (6.7 cents) per kilowatt-hour from sundown to 10 o'clock at night. In addition to this, each society has paid a yearly charge in proportion to its acreage, amounting to about 5,000 crowns ($1,300), and an extra "metering charge" of from 250 crowns to 400 crowns a year. In a great many cases, when rural extensions and tertiary substations had to be built during the war, distribution societies insisting on immediate service were requested to pay an admission fee of 10,000 crowns or 20,000 crowns ($2,500 to $5,000) to compensate for the extremely high cost of construction prevailing at the time.

In order to stimulate the use of electric light and power, a new rate schedule has been worked out with a much lower energy charge. According to this schedule each society pays a yearly sum of 2.75 crowns per tariff unit or share (about 30 cents an acre), plus 350 crowns ($93) per kilowatt of no-load loss. The energy rate is put at 7 öre (1.86 cents) per kilowatt-hour. With an energy consumption of 40 kw.-hr. per hectare (16 kw.-hr. per acre), this schedule gives an average energy cost somewhat lower than formerly, and as soon as the specific consumption exceeds that value, the cost per kilowatt-hour rapidly decreases.

The internal energy tariffs of the distribution societies vary between the extremes of a flat rate of 60 öre (16 cents) per kilowatt-hour and a pure so-much-per-lamp-a-year or so-much-per-hectare rate. The majority of the societies, however, have found it advantageous to use mixed tariffs, with an energy rate of only 10 öre per kilowatt-hour. The fixed yearly charges then average about 8 or 10 crowns per hectare (90 cents to $1.10 per acre).

Three Hundred Thousand Volts in 1934?

IN VIEW of the agitation for superpower and interconnection it is interesting to look back over the history of development in power transmission. The files of one of the most prominent engineers of the industry—one who has had much experience in transmission—indicate that the first transmission line was operated in 1889 at Willamette Falls, Ore. Over this line energy was transmitted at 4,000 volts. The next step was made in 1892, when 10,000 volts was used for transmitting energy over a 28-mile line at San Antonio, Cal. In 1893 11,000-volt transmission was used at Redlands, Cal., the same voltage being used between Niagara Falls and Buffalo in 1895. The Pioneer Electric Power Company in Utah used 25,000-volt transmission in 1896, and from 1900 to 1903 various transmission systems in Mexico and California used 60,000 volts. Growth was then a little retarded, but in 1908 110,000 volts was used in Grand Rapids, Mich.,



and also by the Great Western Power Company in California. The next step was made by the Pacific Light & Power Company, when 150,000 volts was used, and the latest transmission voltage—220,000—was adopted in 1923 by both the Southern California Edison Company and the Pacific Gas & Electric Company.

A significant fact is that, as indicated in the accompanying diagram, the slope of the growth curve has remained almost constant since the beginning of high-tension transmission in 1886.

Asymmetric Illumination Distribution for Ornamental Street Lighting

Sheridan Road Installation in Chicago Meets High-Intensity Lighting Requirements Economically and Esthetically by Directing Greatest Density at an Angle of 22½ Deg. from Curb Line

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FOR a number of years purely utilitarian features were the only consideration which governed the selection of a street-lighting system. Modern street-lighting practice, however, recognizes the necessity of combining artistic effect with efficiency of light distribution. This has introduced problems in the design of street-lighting systems which call for a careful analysis of local conditions and requirements before final selection can be made. City zoning and improvement plans provide for the eventual elimination from streets and boulevards of all unsightly overhead wires and the substitution of underground construction. This has resulted in the development of street-lighting units of an entirely different character from the pendent types which are rapidly being displaced except on interurban highways and in sparsely populated areas.

Modern street-lighting units are distinguished from the overhead types by the term "ornamental" and are generally mounted on ornamental posts of cast iron, concrete or pressed steel, which may be varied in height and design to meet local conditions. On important business streets where esthetic considerations warrant the expense two and sometimes three units are mounted on each post. With this class of "super-whiteway" lighting, however, sufficient illumination can be obtained with single units if lamps are used in sizes up to 2,500 cp. In addition to flooding the streets with light, modern street-lighting practice requires that the lighting units on important business streets shall be of such a character as to direct a certain amount of light upward to illuminate the fronts of the buildings and to bring out their architectural features at night. Such a system produces an effect of height and width, emphasizing the importance of the street and greatly enhancing its appearance.

Safety is an important factor in the design of a street-lighting system, and the use of insulating transformers at the base of each ornamental post to separate the high-tension series current from the post wiring is becoming common practice. This practice also simplifies the location of faults in the system and affords a convenient method of disconnecting defective equipment. Higher intensities of illumination are required on streets and highways today because of the rapid growth of fast-moving automobile traffic. The illumination that was sufficient in the days of the horse-drawn vehicle is now absolutely inadequate. The latest motor-vehicle registration returns show that in the current year more than 15,000,000 motor vehicles were registered in the United States, compared with 300 in 1895.

The efficient control of the light flux is an important factor in ornamental street lighting and was recognized in the solution of a typical street-lighting problem by nine out of eleven prominent illuminating engineers who presented papers at the annual convention of the Illuminating Engineering Society last fall.* In determining the efficiency of a street-lighting unit it is not sufficient to consider its total output in lumens. It is highly necessary to take into consideration the directions in which the luminous flux is distributed.

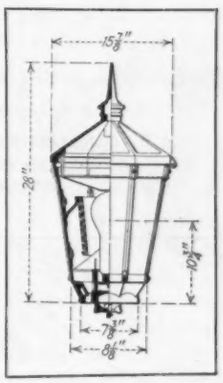


FIG. 1 (LEFT)—THIS "BI-LUX" REFRACTOR CONSISTS OF TWO CYLINDRICAL ELEMENTS WHICH, NESTED TOGETHER, CONTROL THE LIGHT DIRECTION. FIG. 7 (RIGHT)—OCTAGONAL POST-TOP "BI-LUX" REFRACTOR INSTALLED ON SHERIDAN ROAD

A 600-cp. lamp, for instance, equipped with a round-ball diffusing globe and mounted on a single-light post may deliver approximately 5,000 lumens, but since most of the light is directed upward, this would not be considered an efficient unit for modern street lighting.

HIGH-INTENSITY ILLUMINATION

The necessity for higher intensities in street illumination has therefore stimulated the development of street-lighting units which would produce these results without an undue increase in capital outlay and operating costs. There are three methods by which the intensity of illumination can be increased, viz.:

1. By increasing the size of the units.
2. By increasing the number of the units.
3. By conserving the light from the lamp and distributing it in the areas in which it will produce the best results.

*Transactions of the Illuminating Engineering Society, December, 1923, pages 910 and 911.

The first method is undesirable, because it increases the maintenance costs, and unless the mounting heights are increased, this method is apt to produce glaring effects. The second method increases the capital outlay and operating costs. The third method appears to be the most logical, and a number of devices have been developed in recent years to direct the light toward the street surface. The distribution of illumination from ornamental street-lighting units, however, has always been symmetrical in character—an equal amount of light being distributed on the street surface in all directions around the unit. This results in brilliantly lighted areas adjacent to the light source and dark zones between units.

With the modern practice of mounting street-lighting units on ornamental posts installed along the curb line, it is very evident that units which produce symmetrical distribution are wasteful and unsatisfactory in the results obtained. Ornamental posts are spaced at distances varying from 50 to 300 ft., according to local requirements. It is obvious that under these conditions the distance the light must travel to illuminate the area between units is greater than the distance across the sidewalk or even across the roadway. To produce an even illumination, with as much light between posts as is distributed on the street surface adjacent to the units, a light source producing unsymmetrical distribution is required.

One of the earliest examples of asymmetric or unsymmetrical distribution of illumination for street lighting is a special form of reflector described by Dr. C. H. Sharp before the Illuminating Engineering Society about a decade ago. This device was intended to conserve the light flux of an arc lamp and throw it up and down the street rather than to one side. The

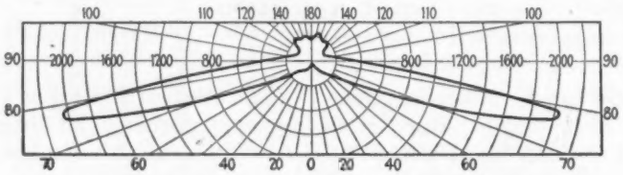


FIG. 2—CANDLEPOWER DISTRIBUTION SHOWING GREATEST INTENSITY IN TWO PLANES ABOUT 22½ DEG. FROM CURB LINE

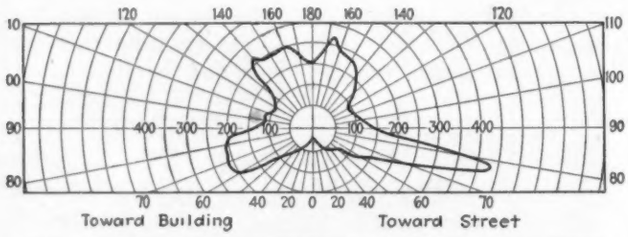


FIG. 3—CANDLEPOWER DISTRIBUTION IN A PLANE AT RIGHT ANGLES TO CURB LINE INDICATING THE LOW INTENSITY TOWARD RESIDENCES

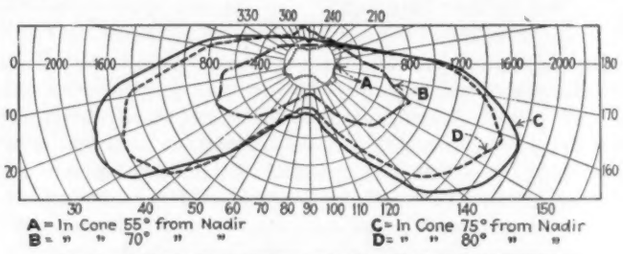


FIG. 4—LABORATORY TESTS ON LATERAL CANDLEPOWER DISTRIBUTION IN CONES VARYING FROM 50 DEG. TO 80 DEG. FROM THE NADIR

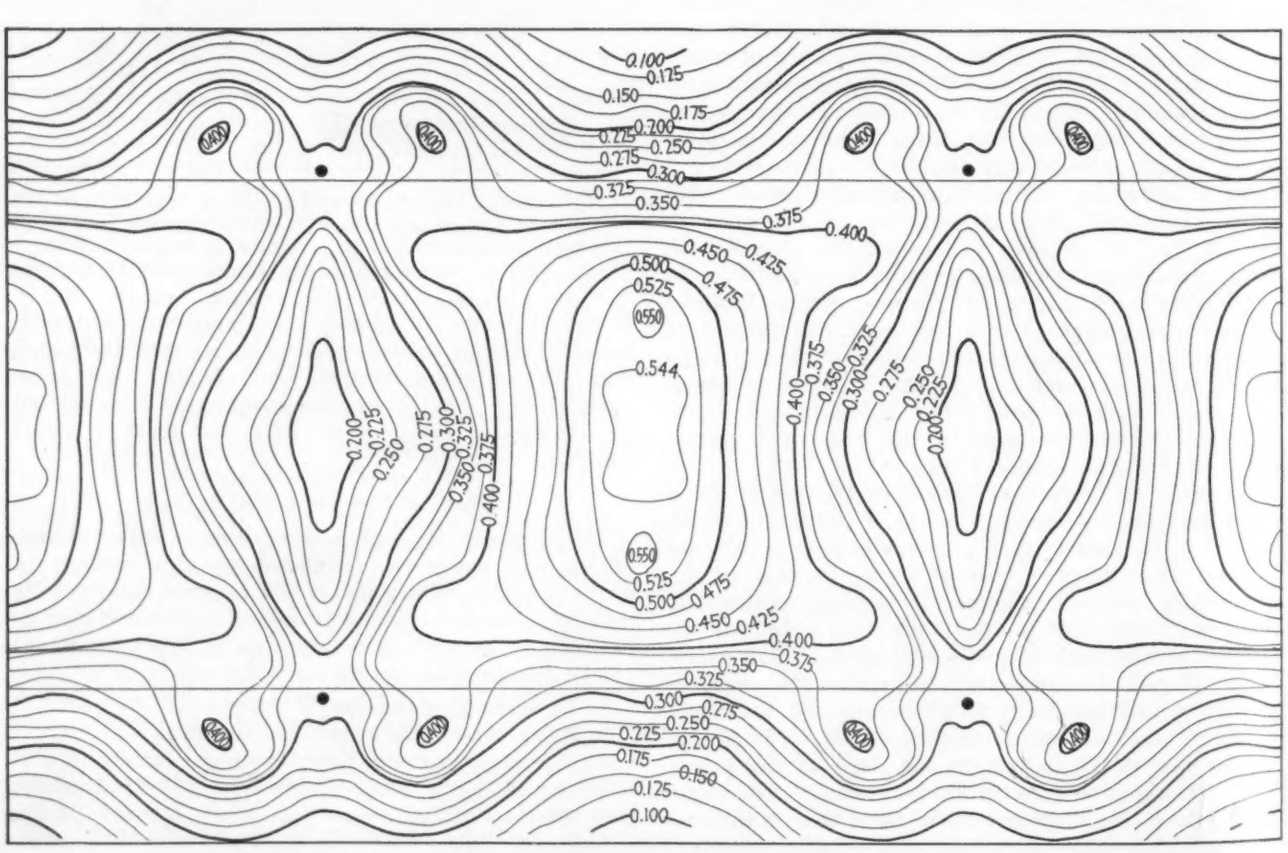


FIG. 5—ISOLUX CURVES WITH "BI-LUX" REFRACTOR, PRODUCING ASYMMETRIC DISTRIBUTION WITH 6,000 LUMEN LAMPS MOUNTED ON 14-FT. POSTS 100 FT. APART

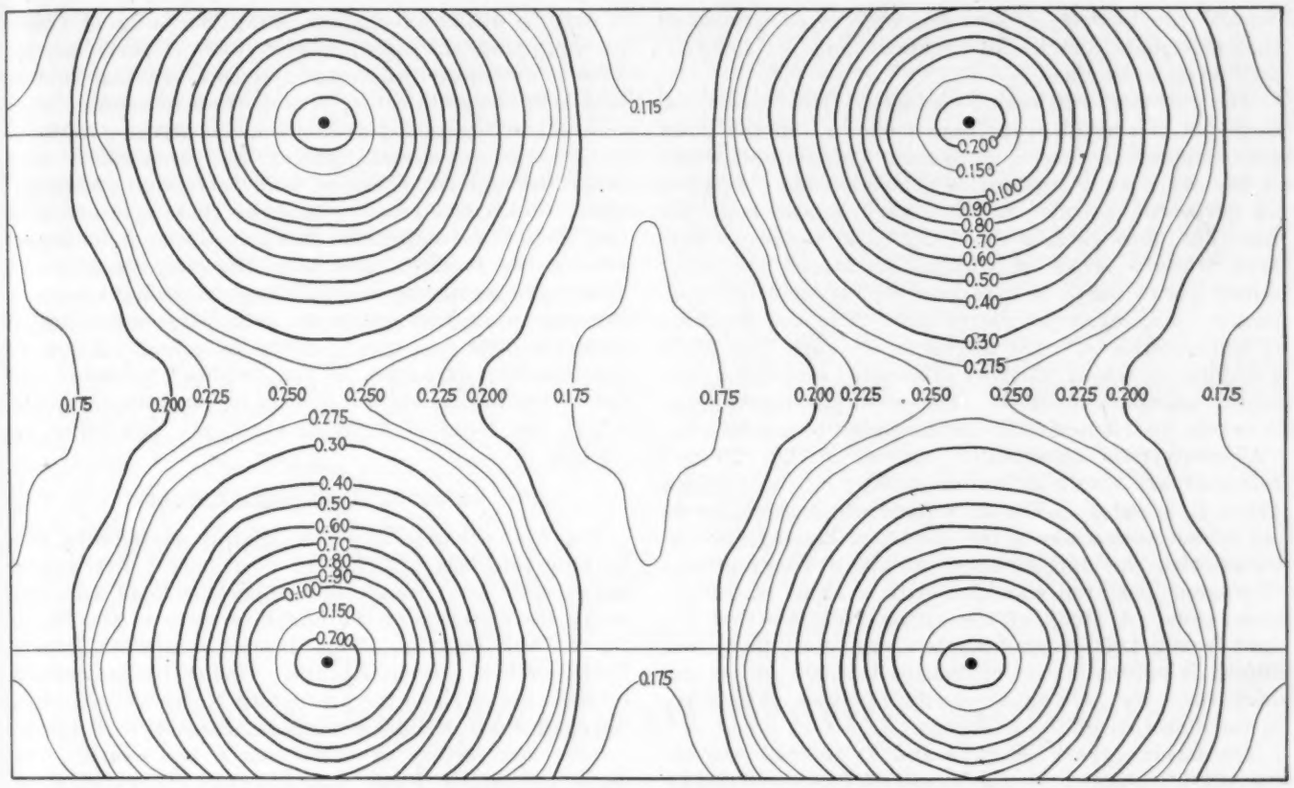


FIG. 6—ISOLUX CURVES WITH TYPICAL REFRACTOR, PRODUCING SYMMETRICAL DISTRIBUTION WITH 6,000 LUMEN LAMPS MOUNTED ON 14-FT. POSTS 100 FT. APART

art of street illumination at that time, however, had not reached the point where such a system was required, and so the idea was dropped. But the need for higher intensities in street lighting occasioned by modern traffic conditions has led to further research along the lines suggested by Dr. Sharp. And street-lighting units have been developed which will control the luminous flux and distribute it over the street surface where it will produce the best results.

The first practical step in this direction was the development of a unit suitable for lighting state and interurban highways which was designed to concentrate two beams of light in opposite directions up and down the highway. This unit, in reality a twin searchlamp, consists of two sets of parabolic reflectors with a lamp mounted in the center with the filament at the focal point of both sets of reflectors.† Each set consists of three white-enameled steel reflectors which intercept the light rays and direct them toward the road surface. This development was followed by a dustproof unit consisting of a parabolic reflector which controls the light from a lamp placed at its focal point and directs it to a double set of refracting prisms, which in turn redirect the light flux up and down the highway.

Further research resulted in the development of specially designed bowl-type refractors, suitable for suspension units, which split the light rays into several beams according to the location of the unit. One of these is designed for suspension at the intersection of four streets, and by means of series of specially designed prisms the light rays are divided into four main beams of equal intensity 90 deg. apart. With this device a maximum illumination is directed along the four intersecting streets. Another unit of this type, suitable for mounting over the roadway between street intersections, divides the light into two beams 180 deg. apart and concentrates it up and down the street.

The developments described in the foregoing paragraphs apply to overhead street lighting equipment and are interesting because they lead up to the application of asymmetric distribution of ornamental street lighting. With ornamental street lighting the problem is complicated by esthetic considerations and by the importance of the appearance of the lighting equipment by day as well as its efficiency by night.

The development of a device which would produce asymmetric distribution of illumination suitable for use in ornamental street-lighting units was announced last fall at Lake George, N. Y., when the equipment was demonstrated for the first time in public. Considerable interest was aroused, and it was generally conceded that the development of this device marked the greatest advance in the art of ornamental street lighting since the Mazda type C lamp was introduced.

THE BI-LUX REFRACTOR

This new device is known as the "Bi-lux" refractor (Fig. 1). As its name implies, it produces a graduated distribution of luminous flux on the street surface by means of refracting prisms. The "Bi-lux" refractor is designed to build up two wide paths of light diverging in opposite directions up and down the street. This is accomplished by intercepting part of the light from the direction of the building, part from the direction across the roadway, and then bending it into the main luminous beams. The angle of maximum distribution of the two main beams is 22½ degrees from the curb line

†Report of Lighting Sales Bureau, N. E. L. A., 1922.

toward the roadway. The intensity is so graduated that an evenly distributed luminous flux is "sprayed" on the street surface.

The "Bi-lux" refractor consists of two cylindrical elements of crystal glass, nested one within the other and clamped together so as to form a single unit which is the shape of a frustum of a hollow cone. A series of horizontal prisms on the inner element bend the light flux downward in the direction of the street surface, while a series of vertical prisms on the outer element bend the light rays into the two main 22½-deg. beams. The minimum distribution is in the direction of the sidewalk at right angles to the curb line, while a slightly increased intensity is directed across the road in the opposite direction. The resultant illumination is evenly distributed with glare reduced to a minimum.

Characteristic distribution curves of the "Bi-lux" refractor are shown in the accompanying illustrations (Figs. 2, 3 and 4). The tests from which these curves are drawn were made by the Electrical Testing Laboratories with the unit mounted within a Westinghouse "Paragon" post top equipped with a clear rectilinear glass globe. A study of the curves indicates that the light from a 4,000-lumen tungsten lamp under these conditions is approximately equivalent to 2,000 cp. up and down the street, 425 cp. across the roadway and 225 cp. in the direction of the buildings.

The isolux curves (Figs. 5 and 6) indicate the increased illumination on the street surface produced by asymmetric distribution with the "Bi-lux" refractor as compared with the illumination obtained from a typical refractor combination producing symmetrical distribution under similar conditions of lamp, spacing and mounting height. It will be noted that the intensity of illumination at a point in the center of the road midway between four posts is approximately 75 per cent greater with the "Bi-lux" refractor than with the symmetrical distribution. This refractor controls practically all of the light from a lamp with the exception of a small portion of the upward illumination. This upward light, which is negligible compared with the total output of the lamp, may be redirected, if desired, by means of a specially designed reflector. Or it may be utilized for illuminating the building fronts by equipping the lighting unit with a glass canopy. This is desirable in downtown streets to bring out the details of the architecture of important buildings.

Another interesting development in asymmetric units for ornamental street lighting has been made with octagonal lanterns equipped with refracting panels designed to produce results similar to those obtained with the "Bi-lux" refractor. In this case three of the panels toward the building side have the characteristics of reflectors, permitting a small amount of light to pass through, while the others are refracting panels which bend the light flux up and down the street. A test of the relative advantages of the "Bi-lux" refractor and the refracting panels will shortly be made in St. Louis, where one hundred units of each type are being installed.

SHERIDAN ROAD INSTALLATION

The first ornamental street-lighting installation embodying this new principle of asymmetric distribution has recently been completed on Sheridan Road, Chicago, under the direction of the Commissioners of the North Shore Park District. This district comprises Rogers Park north of Devon Avenue. Owing to its location between the city and the prosperous North Shore towns, Sheridan Road, besides having considerable local traffic, is the main artery of travel north and south. The dense automobile traffic passing along Sheridan Road necessitated a high intensity of illumination, and after a careful study of the different types of modern street-lighting units the Commissioners decided to install the new asymmetric system. Therefore Westinghouse "Octagonal Junior" post tops (Fig. 7), equipped with syenite glass panels and "Bi-lux" refractors, were selected. Since this part of Sheridan Road is largely residential, the canopies were equipped with upper reflectors to redirect downward the upward component of light, which otherwise is utilized for illuminating the building fronts. The units are mounted 14 ft. 6 in. high to light-center on "Massey Hollow-spun" concrete posts which harmonize with the concrete posts installed on other sections of Sheridan Road. The posts, num-

FIG 8—UNIFORMITY OF ILLUMINATION IS EVIDENCED BY THE WAY THE STANDING AUTOMOBILE APPEARS IN CLEAR OUTLINE

bering 154, are spaced 120 ft. apart on both sides of the street opposite one another. The width of the paved roadway is 54 feet and this installation runs for about 1¾ miles. The lamps are 6,000-lumen, 20-amp. "Mazda C," operated from Westinghouse 24-kva. constant-current regulating transformers installed in a substation adjacent to the installation. The energy is supplied by the Commonwealth Edison Company at 2,300 volts through four-conductor No. 8 B. & S. parkway cables rated at 5,000 volts. The system is controlled by Anderson time switches and so arranged that one-half of the lights are turned off at 1 a.m. Each post is equipped with a subway-type insulating 6.6-amp. transformer furnished by the Kuhlman Electric Company, thus rendering the entire system absolutely safe and foolproof. These transformers were mounted in hand holes, 12 in. x 12 in., flush with the ground. Forty-one mushroom traffic guides were also installed. The total cost was $74,400.

The installation was designed by F. A. Gurdes, electrical engineer, and completed by the A. M. Ryckoff Company of Chicago, contractors, within sixty days. In view of the interest aroused by this new system of light distribution, it was turned on by Mayor Dever before an audience of three thousand assembled in the auditorium of Loyola University. A night view of the new installation is shown in Fig. 8. This photograph indicates the even distribution of illumination over the entire surface of the street and sidewalk and also clearly shows how the illumination in the direction of the sidewalk decreases when it reaches the front lawns.

Commenting editorially on the new lighting system, the Chicago *Tribune* on January 1 said:

> A noteworthy bit of modern city improvement of immediate value to many Chicago residents and of potential value to all the rest is the new street-lighting system recently installed along the North Shore Park district. Walking or driving in these winter evenings out of the normal street lighting of Chicago into this section is almost like stepping from a darkened room into brilliant sunshine. . . .
>
> The result is a street evenly illuminated, with equal visibility between the standards and immediately around them, no glare in the eyes of motorists and pedestrians, but ease, comfort and safety to all concerned.

Fundamentals of Meter Service

Advance in Practice from Earliest Days Has Been Directed Toward Realization of Desired Results—Still Much Development to Come—Circuit Breakers Instead of Fuses Proposed, with Meter Included in Same Box

By R. C. FRYER* and L. J. GREGORY†

THE first protective devices for customers' electric service protection were, as is often desirable, very simple, consisting only of an open-link fuse. Since that time little progress in the fundamental idea of customers' protective devices has been made except that the fuse, formerly an open link, has been inclosed. This came about chiefly through the consideration of fire hazard.

Later, following the development of alternating-current distribution, personal hazard was recognized, and mainly through efforts of manufacturers of such devices the fuse and switch were inclosed in a protective covering. This move was accepted slowly and with some trepidation by the central-station industry, which, as is yet the case, saw the salient point of cost distribution to be overcome. Incidents easily recalled to the minds of many who do not yet consider themselves old in central-station work do not bring with them pleasant reflections on the methods by which the first "safety switch boxes" were introduced.

Let it here be understood, however, that this does not detract from the value of results attained after persistent efforts to introduce these "boxes." It is desired merely to emphasize the point that the "safety-box" proposal was not enthusiastically received by the central-station industry, and that to protect their business interests, some manufacturers endeavored to "put it across" by methods which were not well received. Evidences of the antagonism aroused at that time may yet be felt, and to this opposition some attribute the failure of any operating electric association to adopt as standard any type, make or design of meter-service box.

It might here be stated that, sales propaganda to the contrary notwithstanding, there is officially at the present time no standard meter-service arrangement which has been officially approved by either of the larger central-station organizations of the United States—the Associated Edison Companies and the National Electric Light Association. None the less manufacturers of meter-service boxes assert—while they are eager to claim a large percentage of adoption for certain types of boxes manufactured under co-operative planning—that the central-station industry is calling for many modifications of the output which these manufacturers are making.

When the first "safety boxes" were introduced the conditions were not favorable to co-operative efforts on the part of the central stations to analyze the situation fundamentally; thus the first opportunity to prevent endless confusion over requirements was lost. This is usually the situation when an article which is not fundamentally correct is forced on the market. Extended adoption of such articles is usually followed by economic waste and failure of the article to satisfy fully the desired requirements.

Today there are perhaps none who possess the courage to say that any certain make, type or design of meter-service box is the box answering the fundamental requirements, much less answering the many and varied incidental requirements imposed by local conditions.

Not officially to express the opinion of any operating company or utility, not with the intention of indorsing or opposing any device or idea now in use, with a full

*Superintendent electric meters Union Gas & Electric Company, Cincinnati.
†Meter engineer Union Gas & Electric Company, Cincinnati.

realization that it is unsafe to prophesy, and only with the object of expressing constructive criticism, do the authors offer for consideration that which follows.

Once in a great while some engineer, manufacturer or inventor will give to the public an idea basically sound both technically and economically, and in such cases it is a source of profit and satisfaction to both user and maker. Strong protection on such articles is obtained, and where merit justifies protection it is not destructive. The wide and enthusiastic reception will lead to large production and distribution, and thus the attendant economic problems will be met. This has been and is being seen in the growth of the central-station industry as well as in the production of motor cars, the telephone, radio and many other current lines of endeavor and manufacture which to a large degree answer the needs they are intended to serve. The early designs of motor cars, for instance, had no electric lighting or starting system—in fact, not even a bumper or windshield—yet the fact that these cars largely answered the need for which they were created is proved by the growth of the automotive industry. Standardization in that industry, although largely accomplished, is yet going on. In the first instance it ranked as only a minor problem.

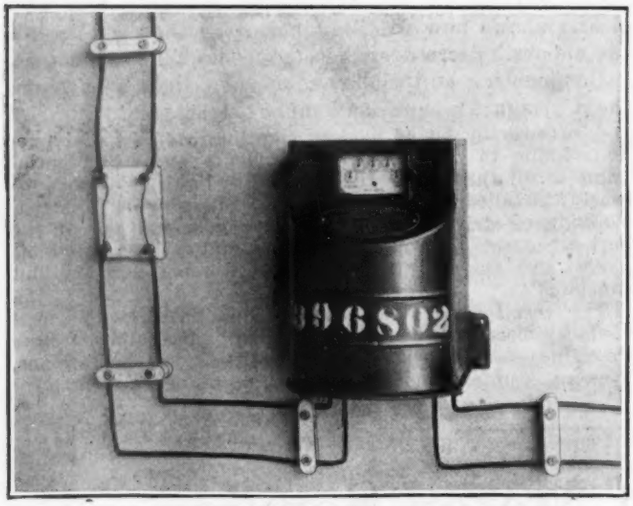


FIG. 1—OLDER TYPE OF INSTALLATION, SHOWING OPEN-LINK FUSES FOR PROTECTION

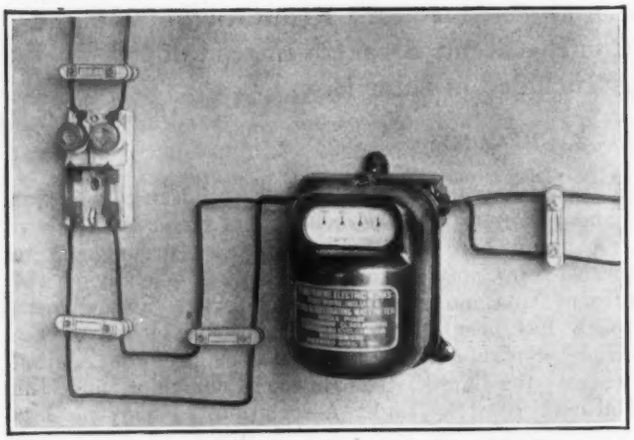


FIG. 2—FIRST STAGE OF DEVELOPMENT, SHOWING INCLOSED FUSES BUT OPEN SWITCH

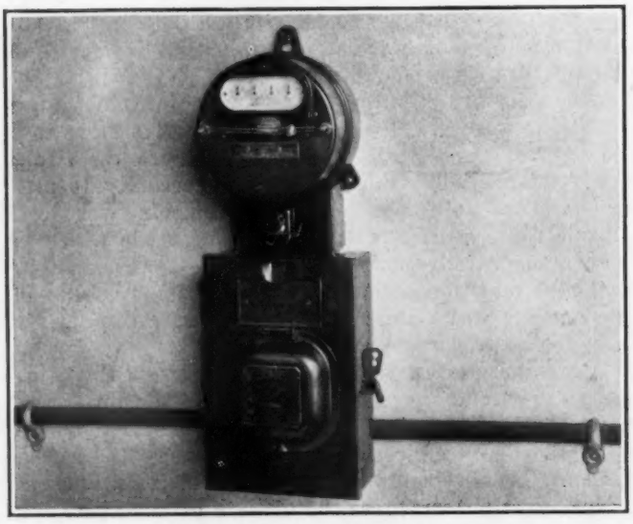


FIG. 3—SUBSEQUENT DEVELOPMENT, SHOWING HOW FUSES AND SWITCH ARE INCLOSED IN A "SAFETY BOX"

Standardization usually follows the general adoption of any device. In the case of the meter-service box an attempt to reverse this order was made, for its adoption in any form has in many localities not yet been assured. In the opinion of the writers this is due to two things. First, the fundamental practical needs have not been met to a large degree, and this is a contributing factor to the second reason, which is that economic motive (profit in dollars and cents) is neither fully applied nor fully appreciated as far as applied in any device now on the market. This situation is further aggravated in the minds of some by a belief that the patent situation is largely responsible for concerted action on the part of some manufacturers to force the adoption of their product. This belief is a great handicap to these manufacturers, but it might be overcome, as it has often been in other lines of industry, if the device fully met the needs.

These fundamental requirements for meter-service boxes are threefold:

1. Protection against fire and personal hazard.
2. Protection to the utility against unauthorized tampering with service.
3. As a commercial proposal sufficient inducements must be offered, in addition to the protective features, to induce either the utility or the customer to invest the necessary capital.

To get down to realities, consider the first requirement. It cannot be denied that this requirement is largely met, but not fully. The customer of a utility invests in a meter-service box of the best and latest design, whatever it may be. He has access to his branch block fuses. One is blown and replaced with a 20-amp. or 30-amp. fuse because no 15-amp. fuse happens to be available. The second short circuit occurs. The main-line fuses, locked and sealed, let go. The customer breaks the seal on his meter-service box and renews the main-line fuse, perhaps with a new 30-amp. fuse, perhaps with a copper cent. Or the customer calls the central-station, and his service after more or less prolonged delay is renewed, but not without cost to the utility. The customer claims that the box belongs to him. The public service commission supports this contention and says a customer may open his meter-service box and renew his main-line fuse if he then informs the utility—but does he inform the utility? The latter surveys its meter services and finds 20 to 30 per cent of them unsealed. On many the cover is found open and on some the fuses have been plugged. In such cases where is the protection against fire hazards?

Bringing the second requirement into the discussion, where in such cases as that just related is the protection against personal hazard? Like the protection against fire, it has existed only to a degree. So far from there being 100 per cent protection against fire hazard, personal hazard or theft, as some would have us believe, the fundamental requirements have not been met.

If sealing is arbitrarily enforced (and it cannot be fully enforced under present conditions), one feature of paramount importance at all times to the utility company—the customer's good will—is in danger. If the customer's good will is safeguarded by provision of a prompt re-fusing service from the trouble department of the company, what does it cost?

To discuss the third requirement under the above condition, what monetary inducement is offered a consumer to invest in a meter-service entrance box and switch? Do his fuses cost less? The answer may be that he has insurance, both fire and life. As shown above, he may have these in part but not fully, and life insurance to a less degree than fire insurance. In company expense accounts, along with taxes, interest and depreciation is also listed insurance. Speak to the consumer of "insurance" and he would yet think in terms of expense even if he had 100 per cent insurance, which he has not.

From the utility viewpoint, however, even if both the first and second requirements have been met, the central-station company will also think in terms of insurance. Insurance can be and is sold, yet it has largely been a matter of education.

It would seem that the interest of the consumer and the utility are identical. Electric power is sold because it economically replaces steam—an identical interest both in first cost and in operation. Can the meter-service box be shown in terms of identical interest? The authors believe that it can be and, without saying that what follows is put forth exclusively with that idea in mind, they offer it for thoughtful consideration.

Suppose that a consumer pays $5 for a meter-service box and the utility $8 for the meter—a total of $13. Suppose again that a practical way be worked out to build in "one unit" both meter and meter-service switch and box. Conservative estimates based upon the construction of such an article led to the belief that, produced in normal quantities, the cost of the combined units

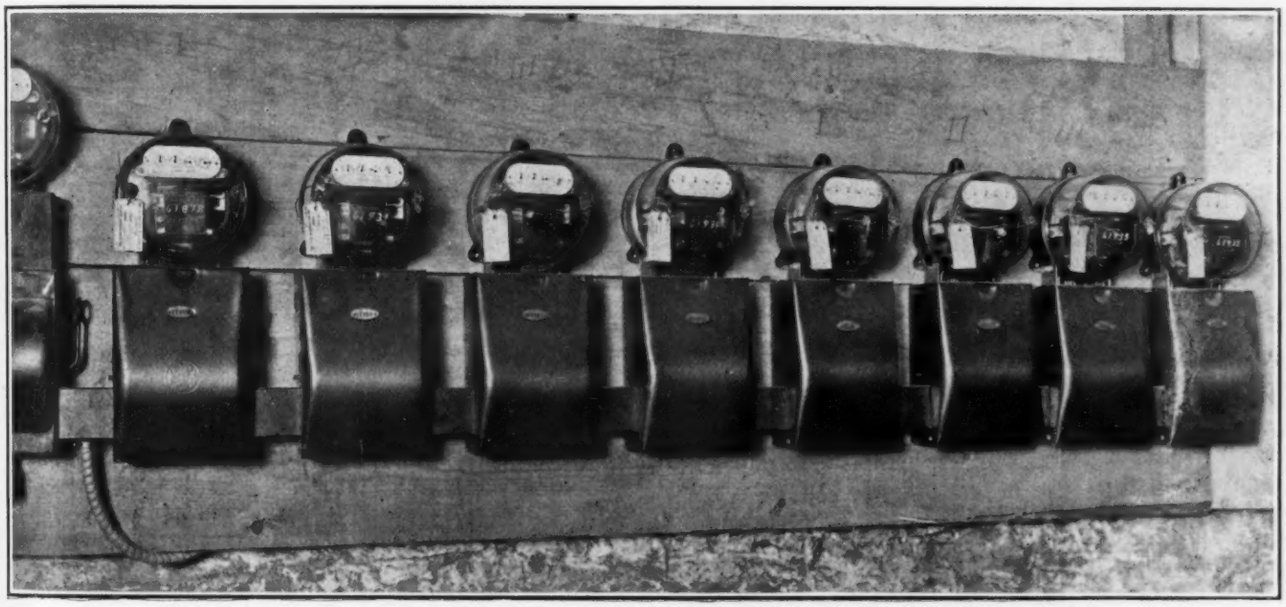
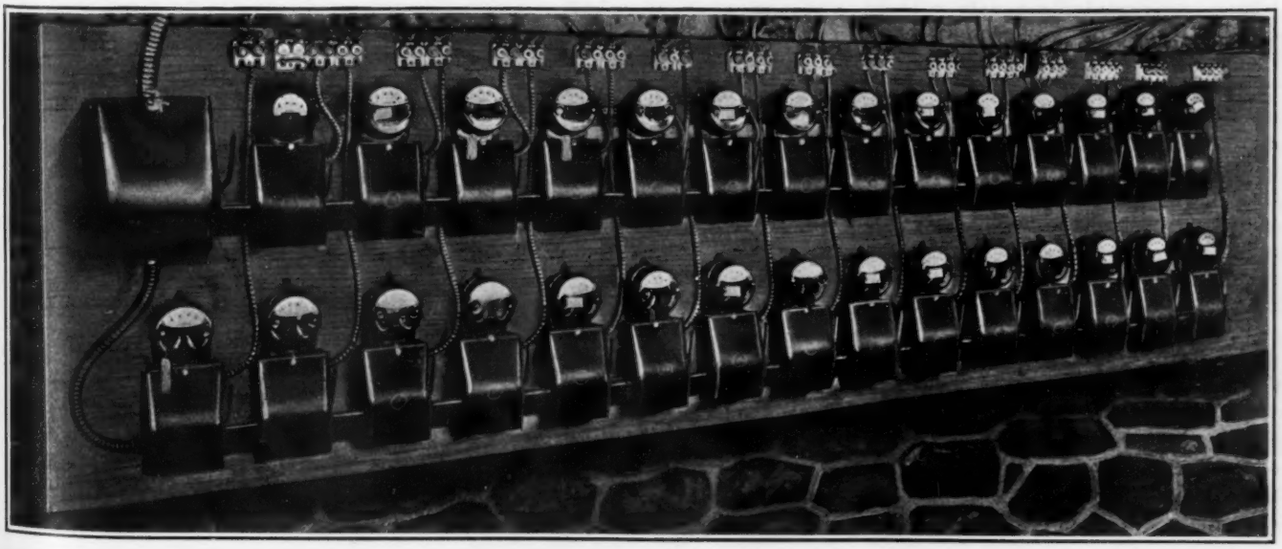


FIG. 4—SUBSEQUENT METHOD OF GANGING SWITCHES: ABOVE—SINGLE ROW OF BRANCH BOXES; BELOW—DOUBLE ROW OF BRANCH BOXES



might be 20 to 50 per cent less than the cost of the two units built separately.

Again, remember that every meter has its service switch and that experience has led to the general practice of the utility owning the meter. Consider the meter terminal-chamber problem and also the resultant problem of meter-service-switch "end walls"; then suppose the protective element mounted on a base common to the meter element also. Would such a problem offer difficulties in design which would confuse present-day engineers?

Going a step farther and observing present European practice in the use of small circuit breakers to protect meter service, the authors think this practice proves that a moderately priced, reliable circuit breaker can be made a component part of the meter unit under consideration. It is held that the new unit offers many or all of the following advantages:

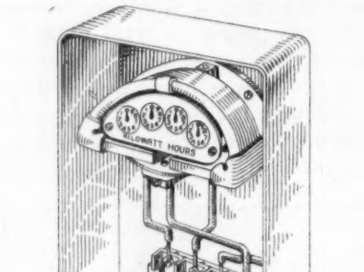


FIG. 5—LATER DEVELOPMENT, SHOWING METER AND CIRCUIT BREAKER INCLOSED IN A SINGLE BOX

1. Lower investment is necessary in meter and meter-service - switch first cost. This is a point complying with requirement 1 above.

2. Opportunity is afforded the consumer to restore his main-line service without opening the box; hence no personal hazard arises. This is part of requirement 1.

3. The consumer finds that he can renew his main-line service without any cost for fuses. This applies on requirement 3.

4. The consumer finds that, instead of having to hunt up a fuse, install a fuse or wait for company troubleman, he is able by the motion of the breaker handle to renew his own service quickly. This also applies on requirement 3.

5. The central station finds that, because the customer can repeatedly renew without cost and without danger his main-line protection, it is unnecessary to incur the expense of sending a troubleman out to renew fuses and unnecessary to incur expense in purchasing and providing main-line fuses. This applies on requirement 3.

6. Both the customer and the utility are interested in such a device because of the fact that full protection is offered against the fire hazard which otherwise might arise from the boxes being opened. This applies on requirement 1, which, together with requirement 2, is fully met.

7. The use of this device answers the question of meter-terminal standardization. This is another partial fulfillment of requirement 3.

8. The use of such a device would certainly eliminate the use of a terminal chamber, answering the question of meter-service-box end-wall standardization, since none would be required. This also helps to meet requirement C.

9. With a properly designed circuit breaker the use of such a device offers greater limitation of short-circuit current due to (a) time element, and (b) reactance in coil of breaker. This applies on requirement 1.

10. From a central-station viewpoint of relationship with customer the use of this device should work out well. With such a unit points Nos. 1, 2, 4, 5, 6, 7, 8 and 9 are distinct advantages to the central station, and such advantages are not offered by the use of present equipment.

These points offer to the central station incentives for utility ownership of meter-service apparatus. This should be pleasing to the consumer because his investment will be less and because he can restore his service promptly and repeatedly without delay and at no cost to himself. The customer could under this plan offer no objection to sealing the service box because he would have no reason to open it and because its ownership would be transferred to the utility and the customer would possess no proprietary rights. It cannot be denied

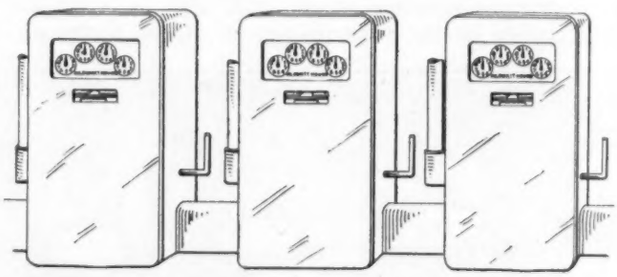


FIG. 6—GANG OF BOXES WITH METERS AND CIRCUIT BREAKERS INCLOSED

then, that, from the point of view of the customer's good will, the above ten points are constructive.

Manufacturers who claim that their product provides all service-entrance and meter-service essentials name the following as these essentials: Protection of life and property, external operation of safety service switch, service cut-out, insurance against tampering and theft of energy, meter-connection block, meter-testing device, lock-off for service suspension. The combined unit here suggested embraces all of these essentials which, indeed, inhere in its fundamental design. Other needs, such as for grounding, ganging, etc., can just as readily be met by the new device as by anything which is now in service.

From another viewpoint, the method of burning a conductor in two to prevent overloads is somewhat crude. This is shown by the fact that engineering practice has been largely away from the fuse and in favor of the circuit breaker. In fact, the design and operation of circuit-breaking protective equipment has become a science in itself. Is there any good reason, then, why as a part of meter service one should continue to burn wires in two in order to protect against overloads, short circuits and grounds?

The illustrations picture the development of customers' service protection from its inception to the present time. All will admit that it pays to look into the future. It is not assumed that any suggested change will be made today or tomorrow, but inevitably the fundamental technical and economic aspects of the situation must and will have recognition, and the sooner this recognition is given the greater will be the profit reaped.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Bankers' Shares of Edison Companies

To the Editors of the ELECTRICAL WORLD:

Referring to the proposed pooling of the stocks of "ten Edison companies" by the United American Electric Companies and the advertisements of the proposed sale which have appeared in the daily papers, it seems to me that this advertisement is to be criticised because of what is evidently an unauthorized use of the name of Edison in such a way as possibly to indicate to readers and prospective subscribers that there is an Edison authority or backing behind the issue.

I do not know whether such an unauthorized use of the name of Edison, with all of the possible consequences of a non-desirable nature, can be prevented, but it would seem very desirable that those using it should be discouraged as much as possible and that prospective subscribers should know exactly the conditions under which a purchase of stock such as this is made.

It would not be difficult to picture a combination such as this producing a very undesirable result upon the minds of the investing public. Seemingly these shares are intended for the small investor of limited means. An unusually high rate of interest is virtually promised, and to support the seeming propriety of such a promise the names of the ten companies are used conspicuously and their gross and net incomes are quoted as well as the population of the territories they serve. With those who customarily compose the class of the prospective investors sought in this instance the reading of such an advertisement is usually of a hurried nature, and a great deal is assumed or accepted from suggestion as well as by direct statement. I should be of the opinion that any one would be justified in assuming that the companies mentioned were interested in and behind the movement and that the investors would be justified in expecting an annual rate of 7 per cent upon the investments.

STOCK QUOTATIONS FOR COMPANIES LISTED IN ADVERTISEMENT OF UNITED AMERICAN ELECTRIC COMPANIES AS OF APRIL 22, 1924

	High	Low	Dividend
Brooklyn Edison Company	111	110½	$8.00
Detroit Edison Company	105½	105½	8.00
Consolidated Gas Company (N. Y.)	62⅛	61⅛	5.00
North American Company	23¼	22⅞	2.00 ($10 par)
Commonwealth Edison Company	127½	126½	8.00
American Power & Light Company	243	240	10.00 in cash* 6.00 in stock*
Metropolitan Edison Company	93	92	7 per cent pfd.†
Edison Elec. Ill. Co. of Boston	171½	171½	12.00
Edison Elec. Ill. Co. of Brockton	208	205	10 per cent, 4 per cent extra*
Southern California Edison Company	101½	100½	8.00

* 1923. † Common practically owned by General Gas & Electric Company

It will be seen from the figures herewith that the rate of interest received by the bankers is but a small percentage over 7 per cent—less than one-tenth of 1 per cent in excess of this figure—and yet 7 per cent is substantially promised to the holders of the stock. In the event of any one of the ten companies for any reason reducing its dividend rate, even under the best conditions the percentage paid to the holders of this stock must be reduced below 7 per cent, and thus it would be assumed, probably, that the entire group of seeming backers of the enterprise had failed to pay the customary percentage and—a matter of an even more serious nature—had failed to carry out an implied promise to pay 7 per cent on the par value of the stock, notwithstanding that the names of at least some of these companies have been used without authority and in what appears to me to be an unfair and improper manner. The table gives a list of the stocks in question, the prices at which they were quoted on April 22 and their respective rates of return.

PUBLIC UTILITY EXECUTIVE.

New York City.

Cement Not the Only Cause of Insulator Failure

To the Editors of the ELECTRICAL WORLD:

The information in the article by Dr. E. Rosenthal in the March 22 issue of the ELECTRICAL WORLD is not new in so far as substance goes and covers only one point in the discussion. All trouble in an insulator cannot be charged to the cement. I believe that there was a German article published several years ago which showed that a solid sphere of porcelain could be cracked to pieces through temperature cycles. This would indicate that there is danger of trouble even though no cement be present. The mechanical failures on some large insulators where no cement whatever has been used are also proof that cement will not necessarily take care of all insulator troubles.

Cement joints have been treated for a number of years in so far as impregnation is concerned. In some classes of insulators the impregnation of the joint affects the electrical characteristics of the insulator but little, while in others the electrostatic balance is destroyed unless the surfaces are coated or conducting material of some nature is used in the cement joint.

We have obtained some wonderful records in the field today on both large and small insulators. We have many thousands of some types of insulators in use, some of these having been in service for more than twelve years without any indication of cracking up to the present time. When it is remembered that some of these insulators do not have the coated, sanded surface or resilient joint, it is seen that it may be a comparatively easy matter to place too much dependence upon the treatment of the cement. Insulators which were identical with some of these successful insulators have in many cases shown serious cracking in from two to four years.

It is comparatively easy to lose sight of the value of temperature gradient, which was treated briefly in a paper that I presented before the Institute on December 11, 1914. It must be remembered that some of the insulators of recent years which have shown the shortest life were insulators for which extravagant claims were made. While the treating of the joint may be an improvement, it is not a cure-all, and there are disadvantages in some cases which may probably more than offset the advantages. The fact that porcelain operates at an exceedingly small factor of safety for the mechanical stress set up, irrespective of load conditions imposed by the conductor, tends to cause failure if the insulator is deficient in any way. Size, composition and temperature gradient are all factors which may cause trouble, even though no cement is present.

A. O. AUSTIN,
Chief Engineer.

Ohio Insulator Company,
Barberton, Ohio.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Inspection Charts Help Forestall Trouble

By O. A. Peterson
Superintendent of Power, Portsmouth (N. H.) Power Company

For several years the Rockingham County Light & Power Company (now the Portsmouth [N. H.] Power Company) has made effective use of daily inspection reports at its Daniel Street generating station, these record forms being designed to permit the results of regular scrutiny of equipment to be written down with the minimum of clerical labor. The boiler-room form shown here is a sheet about 8 in. x 10 in. and contains twenty-five major items to be checked daily by the inspecting force on watch. Each watch makes out one of these forms at the end of the trick, and the chart provides space for every unit installed, a simple check or "V" being used to record inspections of running equipment, an "X" for machines disassembled, cleaned and inspected, and a "T" for instruments tested or calibrated. Notes on repairs required or effected are also included. From these inspection sheets a permanent card record, also shown, is prepared, giving the essential facts about the maintenance work done, rating and name plate data, time out of service, etc. These cards are used on both sides and are 6 in. x 9 in. Electrical equipment is inspected along similar lines and likewise recorded.

R.C.L.&P.CO.
Daily Inspection Report
Boiler Room

.....Watch ..... 19 ..... Engineer

Mark (V) Machines inspected while running
Mark (X) Machines disassembled, thoroughly cleaned and inspected
Mark (T) Instruments tested or calibrated

	UNIT NO.	1	2	3	4	5	6	7	8	9	10	NOTES
1	Boiler											
2	Stoker											
3	Setting & Baffles											
27												
28												

Entered in Maintenance Record.....19..
.....File Clerk.

DAILY INSPECTION REPORT FOR BOILER ROOM

MAINTENANCE RECORD

Rockingham County Light and Power Co.

Name of Apparatus.....
Complete Data.....

Date Purchased..... *Original Cost*.....

Date	Record of Repairs, Etc.	Remarks	Cost		Out of Service

MAINTENANCE RECORD CARD FOR BOILER-ROOM INSPECTION

Diesel Engines for 200-Kw. Load for Small Town

By R. W. Callaway
Superintendent Water & Light Department, Municipal Electric Light and Power Plant, Newkirk, Okla.

Operation since November, 1919, with only forty-five service interruptions is the record of the three 165-hp. Busch-Sulzer Brothers Diesel oil engines directly connected to three Westinghouse 125-kva., 2,400-volt, 60-cycle alternators serving the two 200-kw. load of the 2,533 customers at Newkirk, Okla. Repairs for this period have been virtually nothing, although this year new piston rings are being installed

TABLE I—ITEMIZED OPERATING EXPENSES FOR DISTRIBUTING DIESEL-ENGINE-GENERATED ENERGY

		Kw.-hr.
Distribution:		
Pumping water		96,250
Street lights		143,355
City Hall		12,885
Power plant		12,886
Sold to consumers		280,817
Line loss		45,766
Total		591,959
Operating expense:	$7,847.49	
Kilowatt-hours produced	591,959	
Production cost per kilowatt-hour		0.0132
Distribution, maintenance, overhead expenses:	$19,342.64	
Kilowatt-hours distributed	546,193	
Distribution, maintenance and overhead cost per kilowatt-hour		0.0354
Total cost per kilowatt-hour		0.0486
Revenue:		
Energy sold	$23,334.18	
Inspection fees	77.17	
Power for pumping water	3,984.41	
Energy for street lights	6,150.20	
Energy for City Hall	569.22	
	$34,115.18	
Operating expenses:		
Fuel oil	$2,412.88	
Power-plant wages	4,840.00	
Lubrication	290.87	
Chemicals	207.00	
Miscellaneous	96.74	
	$7,847.49	
Distribution and maintenance:		
Power plant	$496.20	
Distribution system	426.23	
Building and grounds	169.18	
	$1,091.71	
General expenses:*		
Salary of superintendent	$1,200.00	
Salary of utility men	1,345.18	
General and office expense	125.68	
Auto expense	303.96	
Miscellaneous	211.16	
City clerk's salary	450.00	
Office rent	60.00	
Tools and implements	27.72	
	$3,723.70	
Insurance	$426.85	
Depreciation	6,393.50	
Interest on investment	7,706.88	
Total expenses	$27,190.13	
Net profit	$6,995.05	

*Half of combined expense.

TABLE II—ASSETS OF MUNICIPAL ELECTRIC LIGHT PLANT, NEWKIRK, OKLA.

(Fiscal year July 1, 1922, to June 30, 1923.)

Real estate	$1,000.00
Power-plant building	5,500.00
Foundations	3,310.00
Engines, complete	66,520.00
Switchboard, generators, etc	16,200.00
Oil-storage tank	850.00
Pole line, transformers, etc	29,714.77
Street-lighting system	2,600.00
Services	1,736.00
Tools and instruments	616.61
Ford car	400.00
Fuel oil	600.00
Lubricating oil	79.00
Prepaid insurance	813.40
Total	$129,939.78

on one of the engines. Maintenance schedules for this period have been carefully followed. Each unit is completely overhauled every twelve months.

The operating expense of this plant from the auditor's report for the year July 1, 1922, to June 30, 1923, is given herewith. In generating the 591,959 kw.-hr. there was consumed 70,397 gal. of "26-28" gas oil, which cost $1.447 per barrel, each barrel containing 42 gal. By using extra heavy oil 4,200 hp.-hr. per gallon were obtained. With a line loss of 45,766 kw.-hr. the total cost per kilowatt-hour was 4.86 cents.

A bond issue of $110,000 is outstanding against the plant, the latter being valued at $129,939. At the time these bonds were voted, in May, 1919, a steam plant operating at a cost of 6 cents per kilowatt-hour did not produce enough revenue and the difference between the income and the expense had to be made up by taxation; but since this plant has been in operation no taxes have been necessary for upkeep. In fact a profit of $6,995 resulted from the year's operation.

Cleaning Up Streets in Roanoke

IN ROANOKE, VA., an interesting development has occurred which involves using steel poles and secondary rack construction in the business district. In order to relieve the pressure for underground construction and to make the streets more sightly in the business districts, a study was made which resulted in the practice now used. In Fig. 1A is shown a typical downtown street as it appeared before treatment, and Fig. 1B shows the same street after remodeling had occurred. It will be noticed that tubular-steel poles have replaced the wooden poles and that secondary bracket services leave the pole at right angles and after attachment to secondary racks on buildings enter conduit. The poles are of steel, 35 ft., 40 ft. and 45 ft. in height, made by the Railway Industrial Equipment Company, and are equipped with banded steps and wooden-top cross-arms for carrying primary leads. The second leads are all carried in racks mounted on the sides of the poles.

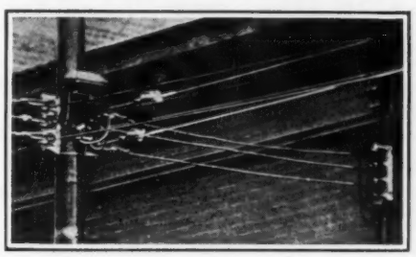


FIG. 2—SECONDARY RACKS AND CONDUIT CONSTRUCTION

For installing the poles six linemen and four groundmen are used in connection with a White truck equipped with a winch. The poles are set in concrete and left untouched for two or three days and are then cut into service, replacing the wooden poles formerly used. An intermediate stage of the cut-over is shown in Fig. 1C. The line crew can change over about two poles per day and the steel poles cost about $1.40 per foot delivered.

In 1915 the first work was done, and twenty-two wooden poles on Salem Avenue were replaced by 35-ft. steel poles at a total cost of $3,176, including the work done on the buildings. Of this total cost, $458 was charged to maintenance and $2,718 to new construction, of which amount the poles involved $546. These poles have given excellent service and there has been a gradual extension of this type of construction. A close view of the secondary rack and conduit construction on buildings is given in Fig. 2.

The result of this construction has been very satisfactory in every way. The streets are better looking and there has been no agitation for underground construction.

FIG. 1—TUBULAR IRON POSTS USED IN REVAMPING CITY DISTRIBUTION

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Details of Secondary Line Services

Connections.—Services shall be connected to secondaries as shown by Fig. 55 (see ELECTRICAL WORLD for May 3, 1924, page 886) and shall be soldered. When services are soldered to medium-hard-drawn secondary wires care shall be taken not to anneal the secondaries. The loops from the wiring shall be spliced to services so as to make a connection electrically and mechanically secure, and the joint shall be thoroughly soldered and well taped. Drip loops shall be provided at the entrance to the service conduit.

Clearances.—All service drops shall have the clearances to ground given in Table X and Fig. 35 (see ELECTRICAL WORLD for March 22, 1924, page 580). Services shall be taken off in such a way that the wires clear the surface of the pole by at least 3 in. When services are taken off at such an angle that this clearance cannot be maintained with the secondary line rack, a second rack shall be installed to take off services on the opposite side of the pole.

Service wires run along a building on brackets shall have clearance of at least 2 in. from the surface. The service outlet must be so located that there will be at least 24 in. clearance between it and any telephone or signal wires where attached to the building and at least 36 in. clearance between the service drops of both systems in an open span. The service wires must in no case be within easy reach from porches, windows or other parts of the building ordinarily accessible to the occupants.

Service Outlet.—On overhead services service wires are to be inclosed in rigid iron conduit from the meter location to the exterior of the building nearest the secondary mains and must never be smaller than No. 10 B. & S. gage rubber-covered wire. The service wires must extend 2 ft. outside of the wire entrance. Lines should not be carried over housetops, other buildings or sheds to reach the wire entrance. The wire entrance must not be less than 15 ft. from the ground and must be in such position as to give proper clearances, as required in Table X.

The rigid iron conduit containing service wires must be installed on the exterior of the building and must then enter the cellar or basement of the building except where the meter is in another place. This conduit must be exposed except where passing through walls or partitions, and all fittings must be drilled for seals. If a main switch and cut-out are provided ahead of the meter and at a different location, the service wires from this switch and cut-out to the meter must be run in iron conduit, with all fittings drilled for seals. In such cases the main switch shall be inclosed in an externally operated, sealed cabinet. In all three-wire services the neutral wire and in all two-wire services one wire must be plainly marked at the wire entrance and at the meter for connection to the grounded wire of the secondary distribution mains.

The ordinary method of connection with street mains will be by overhead wires. Customers desiring feed wires to run underground must install at their own expense the wires and conduit from the building to the pole to which connection is to be made, including a run up the street side of the pole to the secondary mains. The run up the pole must include an inclosed weatherproof fuse cut-out installed not less than 15 ft. above ground. This should never be fused with less than 40-amp. fuses. Conduits up the pole must be provided with an inverted weatherproof conduit fitting and must be grounded inside the building being served.

Type of Service.—All lighting and appliance installations of approximately 3,300 watts or less, or five circuits of 660 watts each or less, shall be two-wire. All installations in excess of the above shall be three-wire. In all cases where three-wire services and meters are installed the branch circuits must be balanced within 10 per cent.

Fusing and Sealing.—Fuses shall be provided ahead of the meter in each side of the two-wire services, in the outside (230-volt) wires of three-wire services and in all wires of polyphase services. The neutral wire of three-wire, single-phase services shall not be fused ahead of the meter. All cabinets or switch boxes and fittings ahead of the meter shall be sealed. Fuses in such sealed cabinets or switchboxes shall have capacities equal to at least three times the rated ampere capacity of the meter, but no such fuse shall be of less than 30-amp. capacity.

Modernizing a Street-Lighting System

Cluster Lights Replaced with Single-Light Units—Efficiency and Appearance Improved—Maintenance Cost Lowered

BY K. A. HILLS
General Electric Company, Davenport, Iowa

THE recent remodeling of the street-lighting system in the town of Bozeman, Mont., has caused very favorable comment and demonstrates what may be accomplished with modern street-lighting equipment in replacing the obsolete apparatus still found in some cities. Under the guidance of a new city manager plans were formulated to put the street-lighting system of the town on a more efficient basis.

The lighting of Main Street originally consisted of a series underground system with three-light cluster posts on each of the four corners at street intersections. Between these corner posts along the curb were two-light brackets, mounted on tubular trolley poles, the pole spacing being approximately 90 ft. along the curb line. A 100-cp., 6.6-amp. lamp inclosed in a ball globe was used in all cases, the globes in the inverted position being 12 in. and the top globes on the corner posts being 16 in. There was a total of seventy-two two-light trolley poles and forty-six three-light corner posts, making a total of 282 100-cp. lamps, each with its ball globe, socket and connection.

The general appearance of the lighting system on Main Street before the change was made is shown in Fig. 1. The maintenance expense on this system was very high, owing to the large number of globes, lamps, sockets and connections employed. In addition, grounds which developed on the circuit in the horizontal arms of the posts were a continual source of annoyance and were expensive to remedy. Furthermore, there was very poor distribution of light along the street because of the poor distribution of light from a ball globe and because of interference of the globes, arms and poles.

The railway company took up its

FIG. 1—OLD CLUSTER-LIGHT SYSTEM WITH ITS HIGH MAINTENANCE AND POOR DISTRIBUTION OF LIGHT

FIG. 2—NEW SINGLE-UNIT STREET-LIGHTING SYSTEM IN THE TOWN OF BOZEMAN, MONT., IS EFFICIENT AND NEAT

tracks on Main Street and allowed the city to use its tubular trolley poles as it saw fit. After careful study and the installation of several different types of lighting units it was decided to adopt a single-light ornamental unit, cut off the trolley poles at the required height and mount the unit on the tops of these, and also to take off the three-light cluster arms on the corner posts and mount a single-light unit on them as in the case of the trolley poles, in this way making the system uniform throughout.

The choice of the single-light unit was determined by actual trial installation, after a comparison of the distribution of light, artistic appearance and cost of maintenance of the units. The unit finally decided upon was the General Electric Company form 9 "Novalux" ornamental unit, equipped with the new medium alabaster rippled diffusing globe with medium alabaster rippled-glass canopy, and form E casing, with series film cut-out socket and receptacle, a 250-cp., 6.6-amp. lamp being used in each unit. The general appearance of the lighting system after the change was completed is illustrated in Fig. 2.

It has been found that one of the big items in reducing maintenance since installing this sytem is the reduction in breakage of globes. This is due to the fact that the lamp may be taken out or replaced or the large glass globe cleaned without removing the globe from the post, as the glass canopy may be removed independently of the globe. The glass canopy is securely clamped to the globe in such a way as to make it appear that the globe and glass canopy are one complete piece of glass, the clamping arrangement being within the globe and canopy.

In this case, as in practically every instance where a cluster lighting system is changed to a single-light system, it has been found that the single-light system delivers a greater candlepower with less wattage than does the former. This is because of the higher efficiency of the larger single-unit "Mazda" lamp. It has also been demonstrated that a single-light system using a lamp of the same candlepower as a cluster system will deliver twice as much light to the street as is possible with a cluster system, owing to the superior distribution characteristics of a single-light unit.

The Montana Power Company, which supplies energy to the system, made the change-over for the city, the total cost to the municipality being $2,696. Maintenance was reduced 35 per cent by the installation of the new system, and this saving was used to pay the cost of making the change.

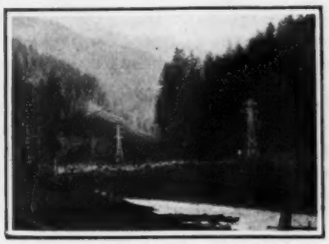
In addition to replacing the cluster system with the single-light system, the city replaced seventy-five open-type series alternating-current arc lamps in the residential section with seventy-five "Novalux" ornamental suspension units for operation on the 6.6-amp. circuit. Each unit was furnished with an auto-transformer for a 600-cp., 20-amp. lamp, with taps for a 400-cp., 15-amp. lamp, each being equipped with band refractor and metal reflector.

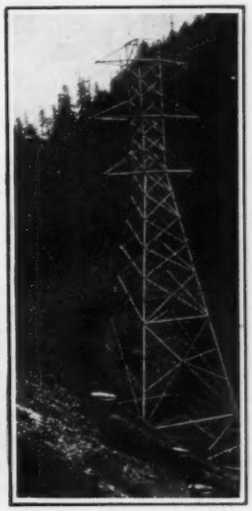
Line Construction Through Rugged Country

SOME of the physical difficulties in transmission-line construction which have to be met by utility companies on the Pacific Coast are shown by the accompanying illustrations. The steel-tower transmission line here shown is that of the Portland Electric Power Company (formerly the Portland Railway, Light & Power Company) to its Oak Grove hydro-electric development now under construction. One of the biggest problems in building the line was the clearing of the right-of-way. The line follows the Clackamas River canyon, which is densely timbered, and the Forest Service required that a clearing 400 ft. wide be made. The clearing of the right-of-way was a much bigger undertaking than the construction of the line.

The line is 18.7 miles long, connecting with a line from a plant at a lower point on the river. At present it has one 250,000-circ.mil copper circuit which will operate at 60,000 volts until additional units are placed in the power house, at which time the voltage will be raised to 110,000. The line was built some time in advance of the completion of the power plant so that 11,000 volts may be used at the construction camps.

The first unit of the Oak Grove project will be completed and in operation by July 1, 1924. The plant will contain a single hydraulic reaction turbine of 35,000 hp., operating under an effective head of 860 ft., and will drive a vertical-type generator rated at 25,000 kw. The prime mover is the highest-head reaction turbine yet constructed and was described in ELECTRICAL WORLD for April 19, 1924, page 778.





60,000-VOLT LINE ULTIMATELY TO BE OPERATED AT 110,000 VOLTS

Left — The Clackamas River was crossed about thirty times to avoid unnecessary angles and expensive clearing and construction on the sides of the canyon. Center—Note the dense stand of timber encountered in clearing a right-of-way for the transmission line. Right — Dead-end towers supporting a 1,600-ft. span, the longest in the line.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Meter Readers Used for Improving Service

METER readers of the Memphis Power & Light Company are required to ask each customer called on whether the service is entirely satisfactory and whether there are any outlets or utilization appliances which are not operating or functioning properly. These readers are required to make a service report on each installation for the company to follow up. If a minor trouble which can be remedied in a few minutes is reported by the customer, such as cord requiring taping or repairing, the meter readers are required to do it while on the job. At the present time customers who report trouble with their house wiring or appliances where repairs of a more elaborate kind are necessary are referred to reputable contractors or to the retailers of the equipment. However, it is planned to start a service department when electrical merchandising is undertaken, which will be soon. Major repairs will then be referred to that department.

The past practice has shown the customer the company's interest in him and, besides detecting trouble before it becomes irritating to the user, has largely reduced the amount of inactive equipment on the company's lines and hence avoided reductions in revenue from failure to use appliances. By referring the customer to reputable contractors he sometimes gains useful information. The contractors on their part appreciate this development of business. Co-operative advertising has also been helpful in accomplishing the same purposes. It is expected that this friendly feeling will be retained when the repair shop is started.

Better Illumination Bureau Helps Equipment Sales

THREE years' service of the Bureau for Better Illuminating at Boston has resulted in the sale of more than $15,000 worth of improved lighting equipment, according to Julius Daniels, who has been in charge of the installation and its use from the beginning. Most of this equipment has been purchased for use in New England, although a betterment job in a Delaware textile plant was the outcome of a visit to the bureau by the engineering staff of that organization.

Industrial Electric Heating Lectures for Metropolitan Power Sales Engineers

A FURTHER development of the courses of instruction for power sales engineers in the application of industrial electric heating was made by the power sales committee of the Metropolitan Section, N. E. L. A., in New York recently. A three-day meeting of this committee, of which Stephen Bennis is chairman, was devoted entirely to a short course of intensive instruction on the principles and application of electric heating, including lectures by the special representatives of manufacturers of this equipment.

Wirt S. Scott of the Westinghouse Electric & Manufacturing Company, L. H. Knapp of the General Electric Company and E. N. Lightfoot of the Cutler-Hammer Company each discussed the subject in its commercial and economic aspects, outlining the importance of this load to the central station, its present status and how best to go about getting the business. An inspection tour to several industrial plants was also made in order that typical applications of heat treating of metals, hardening, tempering, annealing, melting and baking could be studied.

The accompanying illustration shows the twenty-five power sales engineers from the different central-station companies who attended the lectures. The New York Edison Company, the Public Service Electric Company of New Jersey, the United Electric Light & Power Company, the New York & Queens Electric Light & Power Company, the Westchester Lighting Company and the Yonkers Electric Light & Power Company were represented. As a result of this meeting several of these companies have already started surveys of the immediately available heating load and are preparing active campaigns.

Mr. Daniels, who is also illuminating engineer of the Boston Edison company, says that more than five thousand persons have visited the bureau since its inception, that its facilities are now used in the curricula of engineering schools in the Greater Boston district, and that the printing trades have lately decided to utilize the demonstration apparatus at the bureau in their courses of instruction for apprentices. About 275 lecture-demonstrations have been given by the bureau thus far, and no changes of importance in its equipment have been necessary to keep it up to date in displaying the principles of approved illumination in industrial and mercantile establishments.

Some Experience in Machine Billing

Use of Mechanical Equipment Saves Labor and Interest, Reduces Accounting Costs, Improves Accuracy, Delivers Bills Quickly and Helps Good Will

THE rapid increase in the number of customers served by the modern central-station company and the enormous volume of bills that it must handle monthly have put a severe strain on accounting systems and forced a large increase in personnel. It was natural therefore, in the face of rising labor costs, that effort should be made to utilize mechanical equipment, and a very notable success has been attained in recent years in the application of billing machines. A large number of central-station companies have discontinued hand methods of making out the monthly service bills, posting the charges to customers' accounts and preparing the monthly statement on sales, and are doing it in a single operation by a special combined billing typewriter and computing machine. A recent inquiry has developed some exceedingly interesting experiences.

The Detroit Edison Company, for instance, has by the use of twenty-six billing machines found it possible to increase the total number of its accounts by 100,000 meters with an actual reduction in staff. J. H. Lymes, general accountant, says:

The one outstanding feature of machine billing, in our case at least, is that it keeps the unit cost of doing work down in the face of constantly increasing wages. The accompanying tabulation perhaps will show this better than words.

It is interesting to note that in 1924 185 employees are taking care of more than 300,000 accounts, while in 1919 195 employees took care of only slightly over 200,000 accounts. The increase in work done per employee can be credited directly to improvements in the system and the use of improved office machines. The great improvement of 1924 over 1922 is due to the same thing, a change in the system plus further uses of labor-saving office equipment.

The meter readings as soon as they are obtained are posted to a meter-reading ledger sheet by means of a Burroughs subtracting machine. The present reading and previous reading are posted and the subtraction is automatically made and posted. These are posted at the rate of 1,830 per clerk per day as against 980 per clerk per day using long hand. An addressograph is used to place the name and address on the billhead and on the ledger record, which is practically a copy of the bill. The billheads, the ledger records and the meter-reading ledgers then go to the Elliott-Fisher billing machines, where the ledger record, the bill and a proofsheet are made in one operation. The bills are delivered principally by hand, only a few being mailed. From the proofsheet the accuracy of the billing is proved and the earnings are drawn off. A special copying ink is used on the addressograph machines and on the billing machine so that when a duplicate bill is wanted a "Ditto" machine copy of the original bill is made from the ledger record and supplied the customer. Likewise overdue accounts statements are run off on the "Ditto" machine, three copies being made, which takes care of the entire collection routine. The advantage of this, besides speed, is that we know we have an exact copy without checking. In the process of making statements a folding machine and a large-capacity cutting machine are also used.

DATA ON CUSTOMERS' BILLING AND ACCOUNTING

Year	Number of Accounts	No. Employees on Customers' Accounts	Accounts per Employee
1919	202,700	195	1,040
1920	226,000	203	1,120
1921	242,800	190	1,278
1922	258,800	200	1,294
1923	283,800	202	1,400
1924*	301,500	185	1,630

*Three months.

We are so accustomed to the use of mechanical office equipment of all sorts that it would be difficult for us to conceive of our work being done without this equipment, but if one could take the different items of mechanical apparatus individually and stop to think what it would be necessary for us to do without them, the immense saving can at once be realized. Take the modern addressograph equipment, for instance, note the speed at which this equipment works, and compare it with the alternative of typing the name and address on an ordinary typewriter. One cannot even think of a modern office being run without its adding and multiplying machines, and the speed and accuracy of machine billing cannot be compared with long-hand methods. I do not believe that it would be too much to say that without modern office equipment the number of workers would be doubled.

I doubt whether the introduction of machine billing or any other accounting machinery has led to any definite change in policy, but it, no doubt, has enabled us to give better service to the customer and has had its influence on public relations. The fact that when a customer comes to our office for information of any sort he is able to get this information quickly and accurately gives him a much better opinion of us than if he were compelled to wait an undue length of time. The employees in the billing department take the keenest interest in the use of machines of any sort to speed up their work. The introduction of a new machine seems to stimulate them to find short cuts and improvements in routine.

The Hartford Electric Light Company uses thirteen billing machines, and John E. Lynch, secretary and treasurer, stresses particularly the value of accurate typewritten records for the impression which they make upon the customer. He writes:

While, of course, it is a debatable question, we feel that the machine method is a decided improvement over the old hand-billing plan. For one thing, the bill in a printed form is very easily read and understood by the customer. In addition, the ledger card and data sheet are in printed form and the three records are completed in one operation by the bookkeeper. In case of any question by the customer, we show his ledger card directly to him, and the record is very easily followed. It provides a much neater card to present to the public.

We have been using billing machines since 1918, and the fact that these three forms can be filled out in one operation is, in our opinion, a big argument for the use of the machines. But back of this must be the demand for a more complete record, the need of which is not felt by all companies equally. This morning, April 3, our March billing, which includes readings up to and including March 31, covering approximately 50,000 accounts, together with the trial balances on all of the various customers' ledgers and also all statistical information compiled from the customers' accounts, are practically complete. We are getting our bills out at the present time into the hands of our customers in five or six days after the meters have been read.

We did better than this years ago, but our statistical information in the old days was very meager and incomplete as compared with present. Also, nearly every month, we send out a lot

of advertising matter along with the bills, which tends to slow up the delivery of bills.

The Philadelphia Electric Company has stated that it is making an approximate saving of $50,000 a year by the use of billing machines with a reduction of about 25 per cent in the number of clerks engaged and cites the following advantages:

1. Reduction of time between dates of reading meter and presenting bill, which means quicker payment and more interest on the company's money.
2. By machine billing bills are automatically proved in blocks of fifty items, and errors are immediately detected, which reduces greatly the number of complaints.
3. Typewritten records are neater and make a better impression.
4. Much time is saved by the simultaneous writing of bill, ledger sheet and analysis of revenue.
5. Saving of time in sorting.
6. Permanence of records, with typewritten ledger sheets in binders.

The Washington Water Power Company uses four billing machines on approximately 28,000 accounts, handling the account of each customer on one ledger sheet, including power, light, merchandise and contract charges, flat-rate charges and arrears, and the company considers the ability of the machine to combine bill ledgers and abstract and give a separate balance on light and still carry a balance on contract sales its principal advantage. Moreover, as President D. L. Huntington observes:

The installation of mechanical devices has quickened our methods all the way down the line. Our bills are placed in the hands of our customers at a date considerably sooner after meter reading than was possible before. Our dividend checks, pay rolls, etc., are expedited, and we obtain our statements of earnings and expense for the previous month usually on the seventh or eighth of the current month, depending somewhat upon the intervention of Sundays or holidays. I can well remember the time when our statement was nearly a month in arrears of the last day of the preceding month.

It is my impression, without having checked it up definitely, that we have nearly doubled the number of accounts in recent years without adding substantially to the number of accounting employees.

The Commonwealth Edison Company, Chicago, now uses 117 billing machines that handle about 702,000 accounts. Speaking of this company's experience, E. J. Fowler, statistician, says:

Our Elliott-Fisher machines have been used since 1917, and machine billing has been found much more efficient than the former method of longhand billing. Some of the advantages derived from machine billing are:

Six-day billing schedule.

Revenue reports ready by the fifth of each month.

Easy monthly trial balances.

Accurate and legible records.

Satisfactory tie-up of revenue and collections.

Bill, ledger and revenue sheet made at same operation, thus reducing chance for error.

Simplified handling of constants.

Daily proof of all entries, including distribution.

Revenue sheet, which serves several important functions, is obtained with practically no extra effort.

Plenty of trained operators easily secured; any intelligent clerk becomes proficient after brief instructions.

Very rapid collation of forms, preparatory to making entries, made possible by flat writing surface of the bookkeeping machine.

I consider that the most important benefits of our machine billing system are, first, a reduction in errors; second, a material reduction in the time required between date of meter reading and date of bill, and, third, some saving in expense.

Cutting down the time required for the work has made it possible to close the books perhaps a week earlier than formerly, and this, of course, means that the reports are available for the executives that much earlier. The many benefits are so important that I cannot see how a company of any size can afford to continue to send out bills written in longhand.

The time saved in issuing the bills is, of course, worth a very large amount to a company of this size in interest saved. W. C. Richardson, treasurer Indianapolis Light & Heat Company, writes:

Our installation of machine billing has resulted in speeding up our statistical information. It has permitted us to put our billing on a daily schedule basis, making a certain number of customers' bills due each and every day in the month, thereby distributing the posting of records evenly over the period. Under this system our cash receipts are more evenly distributed throughout the month, whereas before our collections were very heavy from the first to the fifteenth of the month. Our installation of mechanical equipment has not given us any additional statistics, but has enabled us to get them more quickly and at less expense.

Such has been the common experience of a large number of companies. The growing number of accounts that must be handled every month adds to the burden of the work, and the large increase in the cost of clerical labor has made the net expense of handling the billing of this growth in business disproportionate. Large and small companies both have sought relief in mechanical contrivances and have found them profitable in many ways.

Combining Appliance and Good-Will Advertising

THE Detroit Edison Company is a consistent advertiser of household electrical conveniences, but has recently hit upon the plan of supplementing its appliance advertising with good-will publicity. The advertisement reproduced here shows how

Stand it anywhere
Clamp it anywhere
Hang it anywhere
Adjust it anyway
Concerning Public Service:
Buss lamp at $2 handiest of all
Practical, yet artistic. A standing lamp that has the added features of clamping or hanging anywhere. Gives you light exactly where you want it. No limit to its usefulness. Attractively finished —and only $2!
Why we're proud of our business
This company is shouldering part of the job of the second largest business in the nation—that of providing Public Utility Service.
Nearly sixteen billion dollars are invested in public service organizations today, more than three times as much as the combined investment in the automobile and steel industries.
This is big business. The only small thing about it is the cost of service to the individual. This, in most cases is on a level with and in some instances below pre-war schedules—
Which, after all, is the biggest thing about it from the standpoint of those who use it.
Detroit Edison Company

HOW DETROIT EDISON LINKS APPLIANCE AND GOOD-WILL ADVERTISING

the company is utilizing its newspaper space for the combined purpose of thus advertising merchandise and promoting good will. The copy used for the good-will advertising is furnished by the Michigan Public Utility Information Bureau. By thus dividing its space the company has been able to accomplish a two-fold purpose without increasing its newspaper advertising cost.

Central-Station Companies Aid Dealers

THE Oklahoma Gas & Electric Company has placed floor space in its offices at the disposal of electrical appliance dealers and a continuous electrical show is maintained. Dealers occupy the space in rotation one week each. The electric company provides an experienced demonstrator. At Tulsa recently the Public Service Company of Oklahoma provided space at its offices for a demonstration of everything electrical for the convenience of the housewife from a curling iron to an automatic cooking range. Exhibitors included the leading electrical appliance dealers, and the show attracted many interested consumers throughout the week.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Stoker Drive for Boilers.—A consideration of the type of stoker drive that should be used for any given set of conditions. The relative advantages of engine, turbine, alternating-current and direct-current motor drives are carefully compared.—*Power Plant Engineering,* April 1, 1924.

Regulations for Pulverized-Fuel Systems.—The report of the National Fire Protection Association committee on dust explosion hazards, containing the proposed regulations on pulverized-fuel installations, has recently been issued. The regulations cover the three general classes of pulverized-fuel systems, namely, indirect, or those in which the fuel is intimately mixed with air at the point or points where used, thus involving storage bins at points of consumption; direct, or those in which the pulverized fuel is fed to a fan by which it is blown as a combustible mixture to large pipes to furnaces or other points of combustion, and unit systems, where the fuel is pulverized at or near the point of use and delivered directly from the pulverizer into the furnace by means of a fan or blower. These regulations are still tentative and are subject to change before final adoption by the association.—*Report of National Fire Protection Association,* 1924.

Generation, Control, Switching and Protection

Experimental Analysis of Stability and Power Limitations.—R. D. EVANS and R. C. BERGVALL.—A method of determining the power limit of a transmission system, taking into account the characteristics of the synchronous condensers and load in conjunction with those of the transmission line, is described. The power limit of a transmission system divided into two sections by an intermediate synchronous condenser station is determined and compared with that of the same system without the condenser station at the midpoint. The theory was checked by shop tests on an artificial transmission system of sufficient capacity to allow accurate results to be obtained. Tests were also made on voltage stability, hunting and the effect of short circuits which cause the system to pull out of synchronism.—*Journal of A. I. E. E.,* April, 1924.

Inductive Grounding of the Neutral of Cable Networks.—E. NEUMANN.—In the municipal underground cable system of Berlin, operating with 30 kv., extensive practical tests were made before the final inductive grounding protection was installed. The author describes at length the results of preliminary investigations with direct and ohmic resistance grounding of the neutral point. Direct grounding removed the danger of excess voltages but caused grave troubles due to overcurrents in case of accidental phase grounds. So intense were some of these troubles that the main transformers were unable to withstand the excessive mechanical forces set up in their windings by short circuits. Actual "jumping" of the entire transformers has been observed. Explosions in cable splicing boxes were violent. No telephone interference was observed. A resistance of 120 ohms was then interposed between the Y-point and ground. The ground current was reduced to a maximum of 145 amp., but this current was still large enough to start an arc between phases and cause a heavy short circuit. In 1921 the Petersen coil, or an inductive resonance grounding, was adopted. A number of the sixty oscillographic tests preceding the standardization of this system are described, vectorially explained and illustrated. The different behavior of the grounding coils with varying degrees of undercompensation or overcompensation is shown. Artificial cable faults were introduced by drilling a small hole into a cable and inserting a fine copper wire between one conductor and the sheath. A novel mechanical method is finally described which permits unskilled operators to adjust the inductance of the grounding coils always in accordance with the number of cable trunks connected to the system.—*Elektrotechnische Zeitschrift,* March 27 and April 3, 1924.

Transmission, Substations and Distribution

Voltage Drop in a Three-Phase Transmission Line.—H. COTTON.—When calculating the voltage drop in a small overhead transmission line the author asserts that it is nearly always possible to neglect the drop due to capacity currents, first, because it is numerically small and, second, because the vector representing this drop is perpendicular to the voltage vector for the middle of the line. For this reason the author does not consider the drop due to capacity current. After a general mathematical discussion of these problems, he considers the specific cases of (a) symmetrically spaced conductors, (b) three conductors in the same plane, and (c) conductors placed at the corners of a right-angled triangle.—*World Power,* April, 1924.

Operating Troubles with Rotaries on Long Transmission Lines.—H. ZIPP.—A substation with several rotary converters was supplied from two different central stations, one 30 miles away, the other 70 miles away. Operation from the nearer plant was satisfactory, but when the other plant was supplying the power the rotaries showed heavy arcing on their commutators, in frequent cases necessitating a complete shutdown. Investigations disclosed very pronounced fifth-harmonic frequencies in the voltage wave, arriving from the plant 70 miles distant. A deviation of as much as 26 per cent from the equivalent sinusoidal wave form was found from oscillographic tests. A three-phase choke coil with three open windings was interposed between the starting transformer and the slip rings of the rotaries, with an air gap so dimensioned as to cause a voltage drop at full load of about 17 per cent. This arrangement corrected the character of the oncoming voltage wave to such an extent that the rotaries operated equally well from either transmission line.—*Elektrische Betrieb,* March 24, 1924.

Units, Measurements and Instruments

Million-Volt Laboratory.—O. NAUMANN.—A year ago the first million-volt laboratory in Europe, belonging to a porcelain factory in Saxony (Germany), was completed. A detailed description of it is given in this paper. A special concrete building was erected for the laboratory, the main testing room of which has a floor space of 66 ft. x 66 ft. with a ceiling height of 43 ft. The testing transformer set contains eight oil filled 125-kw. units, of which four are arranged in the usual Dessauer connection on either side of the single-phase system, with the two outer ends grounded and a potential difference of 1,000 kv. between the ends and the middle. With rising voltage the insulation between successive transformers and ground is increased. This principle gives a minimum of required insulation and results in a remarkably small space being taken up by the set. The apparatus is designed for a single-phase, 50-cycle output of 200 kva. An operating and observing stage, 11 ft. above the main floor, forms a niche in one of the building walls. From a balcony, 20 ft. above the floor, a top view of the tested objects may be gained. Two 75-cm. spheres serve as voltmeter. Their distance can be varied from the operators' stand. A high-powered lamp, with slit and lens accessories, placed on the wall opposite the operator, produces an exact silhouette of the spheres on a screen near the operator, where the gap can thus be measured conveniently and safely. Instead of a traveling crane a rail is fastened to the ceiling, forming a large loop, closed in itself. Along this rail loop travel two small, electrically self-propelled winches, the motion and lifting of which are remotely controlled from the operating stage. These winches serve to support the tested objects. Two large wall bushings transmit the high-potential current through the ceiling onto the roof of the building for outdoor tests. Two oil tanks 9 ft. in diameter are set into the floor for tests on objects under oil. Water and compressed-air piping with suitable nozzles is provided for rain and fog tests. The water tank for

these tests may be filled with distilled water or water of any desired conductivity. A 180-kva. pure sine-wave motor-generator is installed in an adjoining room. The building has no windows and is illuminated by a number of incandescent lamps so arranged as to permit their gradual dimming. A needle gap flashes over at 1,000 kv. at a distance of 2,700 mm. The 75-cm. copper spheres, set to 1,120 mm., flash over at 1,100 kv. — *Elektrotechnische Zeitschrift*, March 6, 1924.

Periscope for Reading the Water Gage of a Boiler.—One of the large manufacturers of water-tube boilers recently requested the Bureau of Standards to devise a plan for observing the water gage on boilers where the gage is in an inaccessible position. Accordingly the design of an optical system of unit magnification for a simple periscope was prepared.—*Technical News Bulletin No. 84 of the Bureau of Standards.*

Illumination

Optical Pyrometer as a Brightness Photometer.—W. E. FORSYTHE.—Several tests are reported in which the pyrometer was used as a photometer. In the first test the pyrometer was used to measure the relative brightness of a black body at different temperatures. For the second test four pieces of paper of different colors were illuminated and set at such distances from the lamp that they had the same brightness as was determined with a Macbeth photometer, the brightness then being measured with the pyrometer. In the third test the ratio of brightness of a ribbon-tungsten lamp was measured for two temperatures, first with the regular photometer and then with the pyrometer. In the last test the pyrometer was used as a brightness photometer, and the brightness of clean snow on which the sun was shining was measured. — *Journal of Franklin Institute*, April, 1924.

Motors and Control

Large Electric Reversing-Rolling-Mill Drive. — Details of a reversing rolling mill which has been in continuous operation since March, 1922, in the plant of the Société Anonyme des Aciéries d'Angleur, Liège, Belgium, are given. The rolling plant comprises a combined blooming and finishing mill consisting of four stands with a mean roll diameter of 37½ in. An interesting feature of the plant is the use of flywheels running a periphery speed of 5.25 miles per minute to smooth the energy curve.—*Iron Age*, April 3, 1924.

Changing Alternating-Current Windings for Different Frequencies.—A. C. ROE.—The author has worked out in detail various frequency changes, compiling tables that should be useful in this connection.—*Industrial Engineer*, April, 1924.

Crawling of Three-Phase Squirrel-Cage Induction Motors.—T. F. WALL.—The author shows how the tendency of squirrel-cage motors to crawl may be investigated so far as the higher harmonics of the flux distribution curve due to the stator windings are concerned. These harmonics are, as a rule, the most significant and dangerous. The higher harmonics of the flux distribution due to the rotor winding may in some special cases also reinforce the harmonics due to the stator windings. The author also considers this second cause of crawling. — *World Power*, April, 1924.

Electrophysics, Electrochemistry and Batteries

Electrolytic Tin.—C. L. MANTELL.—A discussion of the various electrolytic baths for the refining of tin, from the viewpoint of their application on a commercial scale. The advantages, disadvantages and special applications are pointed out, with an exemplification of the reasons for the satisfactory stannous sulphate, sodium sulphate and sulphuric-acid electrolytes. A number of references to literature concerning the various baths discussed are given. —*Paper presented before the American Electrochemical Society, Philadelphia*, April 24-26, 1924.

Catalytic Influence of Metals Upon Mineral Oils.—H. STÄGER.—The operation of transformers, oil switches and other oil-immersed apparatus depends largely upon the perfect condition of the oil. It has been known for some time that certain metals act as catalyzers upon mineral oil and hasten its sludging or contamination. In cooperation with the chemical laboratory of a large Swiss manufacturing concern, the author gives in this paper a very detailed report of his systematic study of this little-known problem. He found that bare copper, brass, tin and zinc accelerate sludging of oil considerably. The action depends upon the proportion between the surface of the submerged metal and the volume of oil, except in the case of aluminum, tin, nickel and iron, with which metals the oxidization at the zone of immersion is of importance. Lead, copper and zinc are eaten away by the generated asphaltogenous acids. The presence of lead liberates a highly oxidizing product of resinous character. All tests were carried on for at least 1,000 hours and up to oil temperatures of 150 deg. C. The data are compiled in curves, tabulations and some microphotographs. — *Bulletin de l'Association Suisse des Electriciens*, March, 1924.

Heat Applications and Material Handling

Fusion Welding of Aluminum.—C. F. NAGLE, JR.—The welding of aluminum is a metallurgical process, and therefore the results should be definite, controllable and sufficiently reproducible. To bring the art to this status, however, requires a correct understanding and application of the principles involved. The author consequently concerns himself with some of the physical laws and fundamental principles. —*Journal of the American Welding Society*, March, 1924.

Coal-Shortage Systems.—H. E. BIRCH and H. V. COES.—The authors deal in a general way with the advantages and limitations of various devices and systems. Particular attention is purposely given to the limitations of the various devices. Besides the matter of handling coal in the central-station plants, the unloading of coal from boats and railway cars is considered. —*Mechanical Engineering*, April, 1924.

Permissible Storage-Battery Locomotives.—L. C. ILSLEY and H. B. BRUNOT.—The authors give detailed information covering the inspection and test for safety of a storage-battery locomotive for mines made by the Mancha Storage Battery Locomotive Company. This machine is the third storage-battery locomotive approved by the Bureau of Mines.—*Report of Investigations, No. 2581, Bureau of Mines.*

Telegraphy, Telephony, Radio and Signals

Carrier Telephony on Power Lines.—N. H. SLAUGHTER and W. V. WOLFE.—The system described employs a metallic circuit and only one watt of energy is used. Condenser couplings to the line wires are used instead of the inductively coupled antennas. The losses in carrier systems are those occurring in the line, in the connected power equipment and in the equipment of the carrier installation, and of these the line loss is small, that of the connected equipment is a function of the carrier frequency and the most serious is that associated with coupling the carrier equipment to the power line. The condenser coupling is held to be more efficient and less hazardous.—*Journal of A. I. E. E.*, April, 1924.

Railway Signaling Installation.—W. J. THORROWGOOD.—A description of the all-electric power signaling installations and electric apparatus installed in Feltham Yard of the Southern Railway in England. Speedy operation of points and automatic track circuit protection are features of this up-to-date yard.—*Railway Engineer*, April, 1924.

Miscellaneous

Standardization of Technical Lantern Slides. — P. WÖLFEL. — Realizing that many technical lantern slides are poorly made, not bringing out to best advantage the desired object, and that each lecturer has his own and not always the best method of preparing his slides, a standardization committee has been formed in Germany with the object of determining the best features of lantern-slide making and of supervising and collecting technical slides and making them generally accessible at headquarters to be established. Some of the rules adopted have sufficient merit to appeal also to American lecturers as a guide for effective lantern-slide making. For example, curves frequently shown on the screen as a graphic help should be always white on a black background. This will not only prevent glare, but it is easy to color the individual curves with transparent water colors to distinguish them. To insure plain visibility no writing on a slide should be smaller than $\frac{1}{8}$ in. Photographs should be either opaqued or have all non-essential parts and background printed faintly, so as to emphasize the main object. All machine parts should include some unmistakable scale, such as an inch rule or a human figure.—*Siemens Zeitschrift*, March 24, 1924.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Circuit Breaker, Quartz Gravel for Separating Gas from Oil in

From the explosion chamber the mixture of oil and gas passes through a system of perforated baffles that partially cool and guide it into the separating chamber. Here the quartz gravel with which the chamber is filled holds the oil but allows the gas to escape into the switch-house header. The oil returns to the tank by gravity.—*General Electric Company, Schenectady, N. Y.*

Color, the Psychology of, a Machine for Determining

Exceedingly fine adjustments of color relations can be made on a whirling disk while the machine is in motion. For example, a yellow disk is placed on the color wheel, and over this is partly placed a blue disk. The two colors blend when the wheel revolves, and the proportions of each color can be shifted by the operator without removing the disks or stopping the machine. At the top of the machine is a graduated scale which automatically registers the exact proportions of the two colors as adjustments are made.—*E. B. Twitmeyer, University of Pennsylvania, Philadelphia (Reported in the Scientific American, February, 1924).*

Frequency Changers, Stator Shifter for

A number of devices have been built for shifting the stators of machines used as parts of frequency-changer sets. Their use makes it possible to shift the phase angle in such a manner that an unloaded set may be synchronized exactly with the line and the load divided at will between sets operating in parallel.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Lead Cable Sheath, Corrosion of, Buried Directly in Trenches

A field study was made of corrosion of telephone cables buried directly in trenches in several towns and cities in Indiana and Illinois, and the conclusions reached have been confirmed by extensive laboratory experiments. Lead containing about 1 per cent antimony is most easily corroded. Commercially pure lead comes next, while lead containing 3 per cent tin is much more resistant. The corrosion is generally proportional to the organic matter present in the soil, and acetic acid is apparently the chief culprit. Gypsum, limestone, cement, mortar, etc., promote corrosion. Ordinary salt is very dangerous, and poor drainage is bad for the cable sheath.—*F. O. Anderegg, Purdue University, Lafayette, Ind.*

Magnetic Potentiometer Method of Determining Normal Magnetization

The bar-and-yoke apparatus used is arranged so that the small bar under test forms part of a closed magnetic circuit, and the magnetomotive force is distributed so as to be proportional to the reluctances of the bar and the yoke, respectively, by use of a magnetic potentiometer which consists of a solenoid of several thousand turns, with soft-iron end plates which make contact with two points of the circuit. The magnetic flux is measured with a test coil connected to a ballistic galvanometer. Tested with samples of annealed Armco iron, this apparatus gave the same curve as the standard ring method.—*A. W. Smith, University of Michigan, Ann Arbor.*

Switches, Electro-Pneumatic, for Automatic Substations

Simplified control circuits, greater interchangeability of parts and reduced space requirements result from the use of this type of equipment.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Synchronous Motor, Frequency Relay for the Field Circuit of a

A reactor is connected in the field circuit and a relay controlling the field switch is connected across this reactor. In normal operation the direct-current voltage drop across the reactor is not sufficient to actuate the relay, but when the motor is out of step a superimposed alternating current is induced in the field winding and the drop across the reactor causes the relay to open the field circuit. Thus, with an automatic starter and an unloading device, the motor takes care of a line-voltage interruption by falling out of step, having the field circuit opened by the relay, then starting again as an induction motor, and finally having the direct-current field switch closed by the relay when within a few per cent of synchronism.—*Truman Hibbard, Minneapolis, Minn.*

Turbines, Auxiliary, Heat-Balance Control of

A thermostat is installed in the feed-water heater and a hydraulic relay, actuated by the thermostat, adjusts the speed setting of the turbine governor so that it will take just enough load to give exhaust steam to heat the feed water to the desired point and no more. In the case of duplex drives the turbine may be made of sufficient capacity so that at times of maximum demand for exhaust steam the turbine will drive the motor as an induction generator, feeding current back to the alternating-current mains, in addition to driving the auxiliary.—*The Terry Steam Turbine Company, Hartford, Conn.*

Welding Electrode, Combined with Flux

The most important achievement in arc welding in 1923 was a radical improvement in the construction of the electrode which makes it easy to combine the desired welding flux within the body of the electrode, thus securing all of the advantages which could be obtained with an externally coated electrode, without its disadvantages.—*General Electric Company, Schenectady, N. Y.*

In Progress or Purposed

Soldered Joints, Failure of, Under Sustained Loading

Some work has been undertaken to determine the lack of ability of solder (tin or lead) to withstand sustained loading, with the object of finding the limits of utility of a soldered joint. In order to obtain these data, long-time tests are necessary which are at present in progress.—*Bureau of Standards, Washington, D. C.*

Steel for Magnetic Cores

Our research engineers have developed a new alloy steel of high permeability which is relatively constant over a wide range. The core losses with this new metal are remarkable low. Its first use was confined principally to radio equipment, but its application may be extended to other lines of apparatus.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Turbine for 1,200-Lb. Steam Pressure

This will be a reducing turbine having an exhaust pressure of 300-lb. gage, which condition led to the development of a high-pressure gland, known as the boiler-feed-pump type, wherein condensate from the main condenser is used as sealing water. The gland acts as a stage heater and retains in the system most of the heat which would otherwise be lost through friction and condensation in the gland.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

X-Ray Tubes, High-Power

A new tube having fifteen times the X-ray energy of the average tube now in commercial use has been produced for therapeutic work. So far the new tube has only been used experimentally. It is rated at 250,000 volts, 50 milliamperes, and is provided with cooling coils which carry the circulating water direct to the back surface of the anode. It is the first high-voltage tube equipped with a cooling system of this type.—*General Electric Company, Schenectady, N. Y.*

Suggestions for Research

Cement, Waterproof, for Insulators

Experiments have been made in Germany on the addition of a fusible tar product to the portland cement used for binding together two parts of a porcelain insulator. After the cement is completely set, the insulator is heated to a temperature above the melting point of the tar admixture. The latter then fills the openings to the pores in the cement and effectually bars the entrance of moisture, thus preventing the subsequent increase in the volume and the resulting cracking of porcelain. For details see *A.E.G. Mitteilungen*, March, 1924, page 100. Since this process may be of considerable importance in this country, further experiments and conclusions are desired.

Oils, Lubricating, Effect of Babbitt on

The component metals entering into babbitt should be investigated with regard to their action as catalyzers or accelerators in the sludge formation in oils from various bases and blends and under conditions approaching those of actual operation. Research chemists should also devote their attention to the production of a prophylactic treatment to give the lubricating oils a substantial degree of immunity against the action of the above destructive agents.—*Prime Movers Committee of the N. E. L. A.*

Rotary Converters, Interpoles for

During a direct-current short circuit noticeable fluctuations in the speed of the machine takes place, and at the same time the direct-current armature reaction may reverse the interpole flux. Both these phenomena are conducive to flashovers, and an investigation of possible remedies is desired. For some interesting experiments in this direction see *Brown-Boveri Mitteilungen*, 1924, Vol. 11, p. 3.

Synchronous Machines, Separation of Transverse Reaction in

The most accurate theory of armature reaction is that brought forward by A. Blondel. The classical work of E. Arnold, "Die Wechselstrom-technik," Vol. 4, is largely based on Blondel's theory, including problems of maximum load, stability, hunting, etc. Lately Blondel has summed up his earlier writings on the subject in the *Revue Générale de l'Electricité*, 1922, Vol. 12, pp. 203 and 235. In this theory two kinds of armature reaction are considered, the direct reaction and the transverse reaction. The direct reaction can be separated from the true armature reactance by a test that is conducted at zero power factor. Apparently no simple test is yet available for the separation or determination of the transverse reaction, and it is desired to develop such a test, using if necessary an oscillograph or other special devices. Knowing the transverse reaction, the behavior of a synchronous machine under abnormal conditions could be predicted more accurately than is possible at present.

Tachometers, Distant-Reading

At the present time it seems that there is no type of distant-reading speed indicator procurable which is entirely suitable for the service demands ordinarily imposed upon it in power-plant service.—*Prime Movers Committee of the N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Southern Power Companies' Bid Up Again

E. A. Yates Explains Muscle Shoals Offer to Senate Committee, Which May Favor Rejection of All Four Proposals—Another Comparative Analysis

AS THE Senate committee on agriculture approaches the end of its hearings on the disposition of Muscle Shoals, the indications are that the committee will recommend rejection of all bids now pending and possibly report a resolution calling for creation of a joint committee of Congress to study the subject more closely. Probably this committee would be clothed with power to negotiate a lease. Democratic Senators from Southeastern states have demanded a vote at this session of Congress, and Senator Norris, who says the majority of the committee under his chairmanship favor his bill for government ownership and operation, disclaims desire to prevent one.

The bid of the Southern power companies, as laid before the House military affairs committee, was explained to the Senate committee by E. A. Yates, vice-president and general manager of the Alabama Power Company, with which are associated in the offer the Tennessee Electric Power Company and the Memphis Power & Light Company. The amended or supplemental offer of the Union Carbide Company was explained by Leonard H. Davis and other witnesses.

Power Companies' Bid

Mr. Yates asserted that the power companies offered $10,000,000 a year for a lease of the hydro-electric development for fifty years under the federal water-power act, the electricity above requirements for fertilizer production to be distributed through a superpower system. The companies offer to purchase outright the steam installation at Nitrate Plant No. 2 for $4,500,000 or to lease it at 4 per cent annual interest on this sum. They offer to pay 4 per cent interest on all units in excess of the eight which may be installed, figuring a possible total of eighteen, with the development of 600,000 hp. The government would build Dam No. 3 and lease it at 4 per cent interest on the cost, or the companies would build the dam, paying two-thirds, the government to pay the remaining third because of navigation advantages. The companies would deliver 100,000 hp. for the fertilizer plant at cost and 40,000 hp. additional on demand, at rates to be fixed by the Federal Power Commission. The companies would organize a fertilizer company with $5,000,000 capital and give $1,000,000 as a research fund. They would lease Nitrate Plant No. 1 and maintain Nitrate Plant No. 2 in a standby condition for the production of explosives in the event of war. This offer, Mr. Yates said, would bring a return of $140,000,000 to the government in fifty years.

The proposal of the Union Carbide Company, as explained by Mr. Davis, is for a fifty-year lease of the hydro-electric plant at Dam No. 2 at fixed rentals of $750,000 annually for the first six years, $1,500,000 for the next four years and $2,150,000 per year thereafter plus additions for each additional unit installed, making a total of $100,500,000 in fifty years with all eighteen units installed; also to lease the steam installation at Nitrate Plant No. 2 at $200,000 a year and own right to lease the hydro-electric plant at Dam No. 3 when built, on terms to be fixed by the Federal Power Commission. The bidder would reserve 50,000 hp. for fertilizer development at Nitrate Plant No. 2 and a like amount at Nitrate Plant No. 1. It would lease Nitrate Plant No. 2 at $150,000 a year for fifty years and Nitrate Plant No. 1 at $25,000 a year, pay a royalty on stone from Waco quarry and share profits on fertilizer sales.

Mr. Davis made an elaborate analysis of the bids before the committee, arriving at figures for the total return to the government which did not differ materially from those put forth by Major-General C. C. Williams and printed in the ELECTRICAL WORLD last week. Thus Mr. Davis put the total return from the Ford bid at $116,505,766 as against General Williams' $115,906,896, the total return from the associated power companies' bid at $134,780,400 as against $134,909,320, and the total return from the Hooker bid at $117,186,985 as against $113,274,738. To the new offer of the Union Carbide Company of $120,000,000, however, he added $52,189,870 as returns for Dam No. 3 (returns from this dam being included also in the other bids just referred to) and thus arrived at a total return to the government, if it accept the Union Carbide offer, of $172,189,870.

Farley Osgood Elected President

In Contest for Chief Executive Office of American Institute of Electrical Engineers He Defeats Charles E. Skinner by Narrow Margin

RESULTS of the election for president of the American Institute of Electrical Engineers, which this year took the unusual form of an open contest between two leading members, no "directors' nominee" being named on the ballot, were made known at the meeting of the board of directors held last night (Friday). As the ELECTRICAL WORLD goes to press it learns that Farley Osgood, vice-president and general manager of the Public Service Electric Company, Newark, N. J., was elected by a small majority over Charles E. Skinner, assistant director of engineering, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

FARLEY OSGOOD

To a representative of the ELECTRICAL WORLD Mr. Osgood said immediately after his election became assured:

"The first thing that comes to my mind is the fact that one of my best friends was defeated in the election, for which I am truly sorry. Naturally I am highly appreciative of the great honor of election to the highest office within the gift of the profession. This mark of distinction most certainly carries with it an obligation on the part of the recipient to do all that in him lies for the Institute in every way possible.

"While I have not been on the board for the last few years, I have never been out of the atmosphere of Institute affairs and thoroughly appreciate the

ideals of the organization, and it will be my endeavor to give sufficient time and energy to the work to carry forward its aims and ambitions in the most logical, economical and far-reaching way possible."

President Harris J. Ryan made an address on "The Atmosphere as a Factor in Electrical Engineering."

California Oregon Power Company Plans New Hydro Plant

The California Oregon Power Company has applied to the California Railroad Commission for an order approving an agreement with the Pacific Gas & Electric Company for the construction of Copco No. 2 plant on the Klamath River in northern California, for a transmission line from the plant to Delta, Cal., and for the sale of the output of the plant to the Pacific Gas & Electric Company. The plant would be a duplicate of the Copco No. 1 plant and located about a mile down stream from it. Plans call for the installation of one 25,000-kw. generator with hydraulic turbine and for the completion of the plant by April 1, 1925.

Los Angeles Bond Issue Fails by 2,430

Complete unofficial returns of the vote on the twenty-one-million-dollar bond issue for the Bureau of Power and Light of the city of Los Angeles, voted on at the May 6 election, give the poll as 104,224 in favor of the issue and 55,757 as opposed to it. As a two-thirds majority was necessary, the bonds lost by the narrow margin of 2,430 votes. The bond issue was for financing extensions and betterments to the municipal distribution system in Los Angeles over a period of three years.

The Power Bureau is preparing to resubmit the bond issue at an August election by means of initiative petition. If this cannot be legally done, then under the city charter the issue cannot be resubmitted until November 6, or two days after the general election, so that the Power Bureau must wait until the city primaries in May, 1925, or call a special election at an expense of $100,000. It is reported that as another means out of its difficulties the bureau will seek to have legislation passed which will reduce the vote necessary to pass bond issues for revenue-producing utilities to a majority.

Valuation Proceedings May Be Blocked in Los Angeles

Suits were filed in the Superior Court on May 12 by the Los Angeles Gas & Electric Corporation asking that the city be enjoined from spending $50,000, as authorized in two ordinances passed at the May 6 election by a majority vote, for defraying the expenses of the California Railroad Commission in making a valuation of the electric properties of the company. The claim is made that the ordinances are illegal.

The city has been trying for a year and a half to have a valuation of the company's property made with a view to condemning it and making it a part of the municipal light and power system. Late last year the City Council passed two ordinances, one for $45,000 for future valuation work by the Railroad Commission and the other to cover $5,000 already spent. As a result of referendum petitions filed by the Los Angeles Gas & Electric Corporation these two ordinances were submitted to the voters of the city at the election just held.

The company has been competing with the municipal system since the city distribution system of the Southern California Edison Company was taken over by condemnation in 1922.

Crocker-Wheeler Officers Are Re-elected

At the annual meeting of the Crocker-Wheeler Company, held at Ampere, N. J., Wednesday, May 14, the officers were re-elected as follows: President, Edmund Lang; vice-president, Arthur L. Doremus; secretary, Herbert C. Petty; treasurer, Theodore S. Fuller; assistant secretary and assistant treasurer, George W. Bower. The following directors were re-elected: Edward W. Brown, Arthur L. Doremus, Hampton D. Ewing, Ernest B. Humpstone, Frank H. Jones, Edmund Lang and Michael I. Pupin. Theodore S. Fuller and Herbert C. Petty were added to the board.

Edison Unveils Bust of Joseph Henry

STANDING in the Hall of Fame that is built in semi-circular form around the library of New York University, overlooking the Harlem River at the northern end of Manhattan Island, Thomas A. Edison on Tuesday of this week unveiled a bust of Joseph Henry presented to the university by the American Institute of Electrical Engineers. The bust is one of ten just added to many already in place above commemorative tablets to famous Americans. Frank B. Jewett, former president of the Institute, made the commemorative address, sketching briefly Henry's achievements as educator, discoverer and scientist. Mr. Jewett dwelt especially on Henry's independent discovery of electromagnetic induction, his manufacture of the first insulated wire and his anticipatory hypothesis concerning the oscillatory nature of electric discharge. His work in building up the Smithsonian Institution, his great part in the formation of the National Academy of Sciences and his many fruitful excursions into fields such as those of acoustics and illumination were also emphasized by the speaker, who concluded by saying:

"Certainly no one of our countrymen is more deserving of a place in this Hall of Fame than Joseph Henry. While the details of his life and his work are perhaps not widely known, the results of his researches are of the most enduring character and for all time must enter intimately into the lives of all civilized mankind. Henry was perhaps the foremost of American physicists. And it is well attested by every record that he was a man of varied culture, of large breadth and liberality of views, of generous impulses, of great gentleness and courtesy of manner combined with equal firmness of purpose and energy of action. He was, in every way and in the best that the word denotes, a scientist, and when he died, just forty-six years ago today, almost the last words which passed his lips were to ask whether the transit of the planet Mercury had been successfully observed."

Courtesy N. Y. Edison Co.

Among the other busts unveiled was one of James Buchanan Eads, presented by the American Society of Civil Engineers. Dr. George F. Swain, professor of civil engineering at Harvard University and former president of the A. S. C. E., made the address.

Many California Voters Sign Petition for State Power Act

A petition bearing more than 38,000 signatures to place the new proposed water and power act on the California state ballot in November, 1924, has been filed with the registrar of voters of the County of San Francisco. The petition contains more than half of the 73,000 signatures necessary in the entire state to insure the measure being placed before the people. The new measure is practically identical with the one which was defeated in 1922 and aims to give the people of California eventually full control of the water and power resources of the state. A board of five appointed by the Governor would have at its disposal half a billion dollars to be used in developing and distributing water and electrical energy and acquiring by any legal means any property necessary therefor.

Middle West System to Have Quarter-Mile Spans

The American Gas & Electric Company, New York, which controls the Ohio Power and other Middle West operating companies, will soon start construction on its transmission line from Philo, Ohio, to St. Albans, W. Va. This line will be characterized by the remarkable length of its spans. It is to be 115 miles long, single-circuit, installed on double-circuit towers, and will be strung with an average of four towers to the mile. In some places where the contour of the country makes it possible to use only two towers per mile this will be done, and certain spans in these sections will therefore be half a mile in extent. The standard height of the towers will be 95 ft., 10-ft. and 20-ft. extensions being used at certain points. The line will consist of a 397,500-circ.mil aluminum cable, steel-reinforced.

TRANSMISSION LINES OF THE AMERICAN GAS & ELECTRIC'S MIDDLE WEST SYSTEM

This new line, in conjunction with several others in process of construction and some at present operating, will be included in the transmission system for the plants under construction at Philo, Ohio, and Twin Branch, near Elkhart, Ind., and the present plant at Windsor, W. Va. The combined lines will transmit within a wide radius the energy that will be generated at these modern efficient plants. When the lines are all erected properties in Ohio, Kentucky, West Virginia, Indiana and Michigan will be linked together in a superpower group.

The Philo plant of the Ohio Power Company, which is expected to begin operation next October, will have an initial capacity of 70,000 kw. and an ultimate rating three times as high. The Twin Branch station will be similar to it in rated capacity.

Brooklyn's Big Generator Goes Into Service

In the presence of the chief officers of the company assembled at the new Hudson Avenue power house, Matthew S. Sloan, president of the Brooklyn (N. Y.) Edison Company, on Monday of this week threw the switch which brought into service the largest generating unit yet installed. This 62,500-kva. turbo-generator of General Electric make, which was fully described in the ELECTRICAL WORLD for May 3, weighs 130 tons and cost nearly a million dollars. A Westinghouse unit of equal rating is rapidly approaching completion, and eventually the station will contain eight such generators.

Provision Injuring Water-Power Act Dropped

The rivers and harbors committee of the House of Representatives has agreed to eliminate from its bill the section which would have prohibited the issuance of a permit for the construction of power dams in navigable rivers or their tributaries until the Chief of Engineers of the army has full information upon which to base a general plan for the most effective improvement of the river, or system of rivers, both for navigation and power development. The action of the committee followed an appearance before it of O. C. Merrill, the executive secretary of the Federal Power Commission, who contended that this section would take the real jurisdiction over water powers out of the hands of the Federal Power Commission and vest it in the War Department.

On learning of the far-reaching character of the provision the committee voted to exclude it. The Secretary of War opposed the legislation, characterizing it as "unnecessary and unwise." He said: "The War Department has been engaged for two years in making a survey of the upper Tennessee River. If appropriations are made available by Congress, it expects to complete the survey within the next two years—that is, four years and more than $500,000 will have been required to survey the upper watershed of the Tennessee River, comprising 30,000 square miles, or about 1 per cent of the area of the United States. If we must await the completion of similar surveys on other streams before any water-power developments are made upon them, we will postpone such development for generations."

Economic Use Insisted On

Federal Power Commission Favors Applicant Best Able to Develop a Stream—New Projects

IT IS expected that the Federal Power Commission will deny the application of Thomas Clark for a license covering a small development on the South Fork of the Merced River. The action on this project is important because it involves an important policy. The Clark development cannot make the same economic use of the stream's resources as would be the case if the larger conflicting application of the San Joaquin Light & Power Company, which contemplates a more comprehensive development of the river, were approved. The Clark project, moreover, is not such that a short-term license could be allowed, as was done in the case of the Excelsior Power & Light Company on the Yuba River. In this latter case it was evident that the comprehensive development could not be carried forward for at least ten years, during which time the Excelsior company's plant could be amortized. In the case of the Clark proposal, however, the commission's engineers believe that power can be bought as cheaply as it can be developed along the lines the applicant proposes.

An application for a preliminary permit has been filed with the commission by Stephen E. Keiffer of San Francisco, covering a development in the Mokelumne River in California. He plans to divert that stream into a large reservoir on Dry Creek, at a point 20 miles northeast of Lodi, and to develop 20,000 hp. In addition, he will use water for irrigation purposes in the Sacramento Valley. This project is in conflict with an application previously filed by the Construction Company of North America, a San Francisco concern.

A declaration of intention covering the construction of a dam 50 ft. high in Totsaliga Creek, near Andalusia, Ala., has been filed with the Federal Power

Commission by the River Falls Power Company of River Falls, Ala. The probabilities are that the commission will not take jurisdiction. It is planned to install 4,800 hp.

ELWHA RIVER PROJECT

The Northwestern Power & Manufacturing Company of Port Angeles, Wash., has applied for a preliminary permit to construct a diversion dam 180 ft. long in the Elwha River. The company plans to carry the water through a canal 3½ miles to a power house, a short distance above the head of the pool, for an existing plant. It is estimated that 20,000 hp. can be developed in addition to the 10,000 hp. capacity of the existing plant. The cost is put at $1,600,000, and the energy produced will be used for manufacturing and supplied to the Bremerton navy yard.

The Northwestern company some time ago made application for a small project on the Lyre River at the outlet of Lake Crescent. This was denied because the commission does not want to give the company a monopoly on two streams in the same region as long as the Elwha River has developable resources. The power resources of the northern end of the Olympic peninsula are limited, and because of the prospect offered for the development of pulp and paper manufacture it is believed to be in the public interest to conserve all of the power that can be developed there.

SUSQUEHANNA PROMISES 50,000 HP.

A much greater amount of power is available in the Susquehanna River above Harrisburg than had been estimated, a report made by Stone & Webster reveals. The examination was made for Frank M. Waring of Tyron, Pa., to whom the commission has issued a license. It had been assumed that only 20,000 hp. could be developed, but detailed study indicates that 50,000 hp. is available. The report shows, however, that the project works will be jeopardized if a bridge about to be constructed near by under an act of Congress is built without sinking the foundations of the piers below the proposed tailrace excavation. The commission has taken up the matter with the Corps of Engineers.

The Idaho Power Company has applied for a license covering its Swan Falls plant on Snake River. This is an existing plant of 12,000 hp. capacity, but a formal license is required because public lands are affected.

Institute Looks Forward to June Meeting

Six Technical Sessions Diversified by Entertainment and Social Meetings Will Fill Program of Five-Day Convention at Edgewater Beach, Chicago

LAKESIDE and city attractions and an excellent program of technical papers, will combine to render this year's annual convention of the American Institute of Electrical Engineers one long to be remembered. As already announced, it will be held at Edgewater Beach, within the metropolitan limits of Chicago but away from the congested districts, in the week beginning June 23. Monday will be devoted to meetings of section delegates and committees, with an informal dance in the evening. On the four following days there will be every morning from 9 to 10 o'clock a "social hour" for the promotion of acquaintanceship and renewal of friendships. On Tuesday the president's address at 10 a.m., sports and entertainment in the afternoon, an informal dinner of the educational committee at 6 p.m. and the president's reception and dance in the evening will fill the day. Entertainment and sports will be provided also on the two following afternoons. Wednesday evening there will be a meeting under the auspices of the standards committee, of which H. S. Osborne is chairman, with an address by A. W. Whitney, chairman of the American Engineering Standards Committee, and Thursday evening an entertainment called "With the Fairies" will be staged. Automobile and boat trips as well as visits of inspection to the Commonwealth Edison Company's stations, the Hawthorne plant of the Western Electric Company, the Gary steel works and other industrial establishments have been arranged. Headquarters of the convention will be at the Edgewater Beach Hotel.

TECHNICAL SESSIONS

There will be three parallel sessions (six sessions in all) for the presentation and discussion of technical reports and papers. These sessions will occupy Wednesday, Thursday and Friday mornings, beginning at 10 a.m. Among the subjects to be treated, as set forth in the accompanying program, are distribution, cables, automatic stations, reactors, communication, electrophysics, street lighting and electrical machinery.

Technical Program of Annual A. I. E. E. Convention, Chicago, 1924

WEDNESDAY MORNING, JUNE 25

Session A

"Automatic Stations for Alternating-Current and Direct-Current Networks," C. W. Place, General Electric Company; "The Cleveland Heights Substation of the Cleveland Electric Illuminating Company," H. L. Wallau, Cleveland Electric Illuminating Company; "Automatic Substations for Supplying 1,500 Volts Direct-Current to Suburban Railways," C. A. Butcher, Westinghouse Electric & Manufacturing Company; "Automatic Motor-Generator Equipments on Edison Service of the Indianapolis Light & Heat Company," Herman Bany, General Electric Company; "Operating Experience with Automatic Equipment on an Edison System," F. D. Wyatt, Union Gas & Electric Company; "Automatically Controlled Hydro-Electric Generating Stations," R. J. Wensley, Westinghouse company.

Session B

"Selective Circuits and Static Interference," J. R. Carson, American Telephone & Telegraph Company; "Transmission Unit and Telephone Transmission Reference Systems," W. H. Martin, American Telephone & Telegraph Company; "Sensitive Radio-Frequency Relay," George Lewis, Crosby Manufacturing Company; "The Transient Visualizer," H. M. Turner, Yale University; "Temperature Rise of Stationary Electrical Apparatus as Influenced by Radiation, Convection and Altitude," V. M. Montsinger and W. H. Cooney, General Electric Company; "Effect of Altitude on Temperature Rise of Electrical Apparatus," R. E. Doherty and E. S. Carter, General Electric Company.

THURSDAY MORNING, JUNE 26

Session A

"Underground Alternating - Current Network Distribution," A. H. Kehoe, United Electric Light & Power Company; "General Light and Power Supply of Chicago," G. M. Armbrust and J. B. Jackson, Commonwealth Edison Company; "Study of Underground Distribution Systems," W. R. Bullard, New Orleans Public Service; "Equivalent Single-Phase Networks for Calculating Three-Phase Short-Circuit Currents," R. A. Shetzline, American Telephone & Telegraph Company; "Standardization in Construction and Operation," M. E. Sindeband, American Gas & Electric Company.

Session B

"Current-Limiting Reactor Characteristics," S. I. Oesterreicher, Metropolitan Device Corporation; "Design, Installation and Operation of Current-Limiting Reactors," H. O. Stephens and F. H. Kierstead, General Electric Company; "Current-Limiting Reactors," W. M. Dann, Westinghouse Electric & Manufacturing Company; "Theory of the Saturated-Core Regulator and Reactor," A. Boyajian, General Electric Company; "Application of the Saturated-Core Regulator and Reactor," D. K. Blake, General Electric Company; "Standards of the A. I. E. E." (brief presentation for discussion of certain sections of proposed revision): Transformers, induction regulators and reactors, John D. Bowles; synchronous converters, John C. Parker; industrial control apparatus, H. D. James; electric arc welding apparatus, F. M. Farmer; insulators, R. E. Argersinger.

FRIDAY MORNING, JUNE 27

Session A

"High-Voltage Cables," William A. Del Mar and C. F. Hanson, Habirshaw Electric Cable Company; "The Dielectric Field in an Electric Power Cable," R. W. Atkinson, Standard Underground Cable Company; "Direct Method of Calculating Capacitance of Conductors," H. B. Dwight, Canadian Westinghouse Company; "Improved Method of Measuring Potential Gradient and Flux Density in Irregular Fields," J. F. H. Douglas and E. W. Kane, both of Marquette University, Milwaukee; "Some Notes on Street Lighting," Preston B. Millar, Electrical Testing Laboratories, New York.

Session B

"Flashing Characteristics of Series and Compound Motors," R. E. Ferris, Westinghouse Electric & Manufacturing Company; "The 35,000-Kw. Frequency Converter for Hell Gate Station," O. E. Shirley, General Electric Company; "The Inertaire Transformer," W. M. Dann and D. R. Kellogg, Westinghouse Electric & Manufacturing Company; "A New Type of Single-Phase Motor," S. R. Bergman, General Electric Company; "Theory and Calculation of the Squirrel-Cage Repulsion Motor," H. R. West, General Electric Company.

[The six sessions are under the respective auspices of the following committees: (1) Protective devices; (2) telegraphy and telephony, and electrophysics; (3) transmission and distribution; (4) protective devices; (5) electrophysics, and lighting and illumination; (6) electrical machinery.]

Measure for Radio Control Reported to House

Federal regulation of radio communication, with special provisions applying the anti-trust laws to any attempt to monopolize the ether or apparatus used in the operation of broadcasting stations, is proposed in the White bill, which has been ordered reported by the committee on merchant marine of the House of Representatives at Washington. The bill is in its main features similar to the one reported last year which failed to become law. It creates a Bureau of Radio in the Department of Commerce, which would be assisted in enforcing the law by an advisory committee. Licenses to operate stations would be limited to ten years.

The anti-monopolistic provision of the bill reads as follows:

"The Secretary of Commerce is hereby directed to refuse a station license to any person, company or corporation or any subsidiary thereof which, in his judgment, is unlawfully monopolizing or seeking to unlawfully monopolize radio communication, directly or indirectly, through the control of the manufacture or sale of radio apparatus, through exclusive traffic arrangements or by any other means. In addition, the general anti-trust laws are made applicable to the manufacture, sale and distribution of radio devices and equipment."

The license fees collectible under the bill from stations and operators range from $300 to 50 cents, many classes of stations and operators being designated. Violations of the orders of the Secretary of Commerce would be punished by heavy fines.

Permit Granted for First Ford Dam in Wisconsin

Following a series of hearings before the Wisconsin Railroad Commission which lasted over a period of several months, a permit has finally been granted to the Ford Motor Car Company of Detroit for the construction and operation of a dam and power plant on the Menominee River 3 miles west of Iron Mountain, Mich., on the boundary line between Wisconsin and upper Michigan. This is one of a number of power sites which the company owns and proposes to develop in Wisconsin and Michigan in order to replace steam power with water power in its plants. It is estimated that an expenditure of $250,000 will be required.

According to plans submitted to the commission, three water turbines of 3,200 hp. capacity each will be installed in the power plant, which will be built across the river in Michigan, and will furnish energy to be used at the Ford woodworking plant to be established at Iron Mountain. The dam is to be 30 ft. high and 400 ft. long and will develop approximately 25,000,000 kw.-hr. a year according to data submitted to the commission.

Owners of one piece of land in the proposed flowage area of the selected site declined to sell their land for backwater purposes, and to overcome this difficulty the commission approved of the establishment and organization of the Ford Hydro-Electric Power Company as a Wisconsin public utility company. Armed with the powers and rights of a public utility corporation, the Ford company can now acquire by condemnation proceedings the lands of property owners who stand in the way of development work.

Water-Power Applications in California

Two permits covering power sites in Nevada and Placer Counties, California, have been issued to the Pacific Gas & Electric Company by the California Department of Public Works. One permit allows the appropriation of 26,670 acre-feet per year from Fordyce Creek in Nevada County for the purpose of developing 17,170 hp. After the water is passed through the company's power house it will be used for irrigating purposes. The estimated cost is $745,500. The second permit is to develop 8,693 hp. by utilizing 100 second-feet of water from the Bear River.

E. B. Perrin, Los Angeles, has filed two applications covering projects in Tehama County. One of these is for 50 second-feet and 12,000 acre-feet of water from Thoms Creek and the other is for 150 second-feet and 20,000 acre-feet from the same source. The first project contemplates the generation of 5,823 hp. and the second a development of 27,272 hp.

The Bear River Water & Power Company, Auburn, contemplates the development of 42,994 hp. by diverting 250 second-feet and 100,000 acre-feet per year from the Bear River in Placer and Nevada Counties.

The Feather River Power Company, San Francisco, has filed three applications for water—from Gold Lake in Sierra and Placer Counties, from Bucks Creek in Plumas County and from Grizzly Creek in Plumas County. All three applications are supplementary to the company's original application.

The development of 24,148 hp. is contemplated by G. de Bretteville, San Francisco. It is the applicant's intention to divert 250 second-feet and 30,000 acre-feet of water per year from the Middle Fork of the Yuba River in Yuba and Nevada Counties. The estimated cost of the project is $3,500,000.

Program of International Management Congress

The first international management congress, which will be held at Prague, Czechoslovakia, from July 21 to July 24, under the auspices of the government of that country, the Masaryk Academy and the principal American engineering and management associations, has put forth the following outline program:

MONDAY, JULY 21

Morning. — "Scientific Management": Nature; principles; objectives; achievements, industrial and other; tendencies and outlook; international importance.

Afternoon.—"The Human Element in Scientific Management": Individual relations emphasized; psychology; research, psychological and physiological; job analysis; scope and phases of personnel work. "Industrial Relations in Scientific Management": Group relations emphasized; wage systems; consent; participation in management; profit sharing; participation in ownership.

TUESDAY, JULY 22

Morning.—"General Budget Control of Operations": Analysis of business conditions and tendencies; market analysis; coordinated sales, production and financial programs.

Afternoon.—"Production Management": Principles and methods of planning and controlling operations.

WEDNESDAY, JULY 23

Morning.—"Sales Management": Principles and methods of planning and controlling operations.

Afternoon.—"Management in the Coal Industry": Present management; problems; proposed improvements in management. "Management of Transportation (Railways Particularly)": Current problems; equipment; maintenance; operating methods; morale.

THURSDAY, JULY 24

Morning. — "City and State Management"; "De-politization"; managing the city as an economic unit; city manager; tendencies in organizing the state as a business unit. "Management in the Federal Government": Tendencies toward reasonable reform; scientific investigation; management of national resources; aids to commerce and industry.

Afternoon. — "Vocational Education"; "Advanced and Specialized Education for Commerce and Business Administration"; "Education for the Profession of Engineering."

Program of World Power Conference

A classified program for the World Power Conference, to be held at London on June 30 to July 12, under the presidency of the Earl of Derby and in connection with the British Empire Exhibition at Wembley, has now been issued. This includes all the papers arranged up to the date of the program's issue by the committees of the various participating countries, which include Australia, Austria, Belgium, British Guiana, Canada, Czechoslovakia, Denmark, Dutch East Indies, Finland, France, Great Britain, Holland, Hungary, India, Italy, Japan, New Zealand, Norway, Poland, Russia, Southern Rhodesia, Spain, Sweden, Switzerland, South Africa and the United States. This program is printed on pages 1023 and 1024 of this issue.

The official reception to the delegates, with the president's address, will take place on Monday, June 30, at 3:30 p.m., and the formal banquet to delegates at 7:30 o'clock on the same evening. On Thursday, July 3, will fall the luncheon given by the British Engineering Standards Association and the American committee's complimentary banquet to delegates.

Thursday, Friday and Saturday, July 10, 11 and 12, will be days especially interesting to electrical engineers. A luncheon given by the Institution of Electrical Engineers (the British society) will be followed by the Kelvin centenary celebration. The Kelvin medal will be presented to Elihu Thomson at 4:30 p.m., and a memorial oration will be pronounced by Sir J. J. Thomson, master of Trinity College, Cambridge, and an eminent electrotechnician and physicist. In the evening the president of the Royal Society will give a reception to invited delegates. On Friday the Kelvin centenary banquet will take place with Lord Balfour as toastmaster. Saturday there will be a visit to Cambridge University under the auspices of the Institution of Electrical Engineers and for electrical engineers only.

Program of Papers for World Power Conference

Division I—Power Resources

SECTION A—NATIONAL REVIEW OF POWER RESOURCES

Australian Commonwealth.—"The Power Resources of Australia."

Austria.—"The Development and Utilization of Water Power in Austria," Bundesministerium für Handel and Verkehr; "The Coal Resources of Austria," Bundesministerium für Handel und Verkehr; "The Utilization of the Power Resources of Austria, with Special Reference to the Consumption of Electric Power." Direktor Ing. Eugene Karel; "The Electrification of the Austrian Federal Railways," Ministerialrat Dr. Ing. Arthur Hruschka.

Belgium.—"Ressources en Energie que Renferment les Gites de Combustibles Minéraux de la Belgique," A. Renier; "Production et Consommation d'Energie en Belgique—Bilan Calorifique du Pays," M. Delmer; "Organisation des Cours d'Eau en Belgique pour la Navigation et la Production d'Energie," Lieutenant-Colonel Fontaine.

British Guiana.—"The Water Power Resources of British Guiana."

Canada.—"National Review of the Power Situation in Canada," J. B. Challies.

Czechoslovakia.—"Review of the Natural Sources of Energy and Their Use in Czechoslovakia."

Denmark.—"The Water-Power Resources of Denmark," A. Carstensen.

Dutch East Indies.—"The Water-Power Resources of the Dutch East Indies," A. Groothoff; "Fuel Power in the Dutch East Indies," G. J. L. Coninck Westenberg.

Finland.—"Power Resources of Finland."

France.—"Inventaire des Ressources Hydrauliques de la France," M. de la Brosse; "Régularisation des Cours d'Eau," M. Genissieu; "Electrification du Bassin Houiller du Pas-de-Calais"; "Electrification d'une Houillère Moderne"; "Inventaire des Ressources Houillères Existant en France," M. Guillaume; "Production d'Energie Electrique par l'Utilisation des Gaz de Hauts-Fourneaux et de Fours à Coke," M. Cornu-Thénard.

Great Britain.—"The Coal Resources of the World," Sir Richard Redmayne; "The Physical and Chemical Survey of the National Coal Resources of Great Britain," Dr. C. H. Lander; "Oil Production in Its Relation to the Resources and Needs of the British Empire," Sir George Beilby; "A Review of the Water-Power Problem in Great Britain and Ireland," Prof. A. H. Gibson; "The National Development of the Water-Power Resources of Scotland and Its Relation to Imperial Power Problems," Dr. J. F. Crowley and Eric M. Bergstrom.

Holland. — "Power Resources of the Netherlands," Prof. Ir. F. K. Th. Van Iterson.

Hungary. — "The Power Resources of Hungary."

Indian Empire.—"National Review of the Water-Power Resources of the Indian Empire." J. W. Meares; "Water Storage Conditions in India," S. K. Gurtu.

Italy.—"General Report on the Water-Power Resources of Italy, Developed and Undeveloped" (historical, economical, statistical), Prof. G. Mortara, with the assistance of the third section of the Superior Council of Public Works; "Italian Organization for Collecting Data on Water Power with a General Review of Local Hydrological Features in Relation to Power Generation," Prof. G. de Marchi, with the assistance of the Hydrographic Survey of the Ministry of Public Works; "The Production of Hydro-Electric Energy as a National Problem," Ing. Angelo Omodeo.

Japan.—"The Power Resources of Japan."

New Zealand.—"The Water-Power Resources of New Zealand."

Norway.—"Hydrography of Norway," O. Rogstad; "Water-Power Resources of Norway, Developed and Undeveloped," I. Kristensen; "Cost of Developing Water Power," S. Kloumann; "The Coal Fields of Spitzbergen and Bear Island," A. Hoel.

Poland.—"Economic Situation and Power Resources of Poland."

Russia. — "Power Resources of Russia" (Coal, Naphtha, Water Power and Forests); "Utilization of the Resources of Russia"; "Production, Transmission and Distribution of Electrical Energy."

Southern Rhodesia. — "Review of the Water-Power Resources of Southern Rhodesia," C. L. Robertson; "The Coal Resources of Southern Rhodesia," H. B. Maufe.

Spain. — "National Review of Water Power in Spain," Pedro M. González Quijana; "Hydraulic Régime of Several Spanish Rivers," Carlos Mendoza; "Canalization and Utilization of Water Power in the Guadalquivir Between Cordoba and Seville," Carlos Mendoza.

Sweden. — "The Power Resources of Sweden," F. V. Hansen.

Switzerland.—"The Power Resources of Switzerland."

South Africa.—"The Power Resources of the Union of South Africa."

United States of America.—"General National Review of Power Resources, Distribution and Utilization," O. C. Merrill, N. C. Grover and M. R. Campbell; "Regional Review for Northeastern States, with Particular Reference to New Uses for Energy, New Methods of Application and Relative Costs, and Expanding Markets and Delivery," John W. Lieb; "Similar Regional Review for Central and Southern States," Samuel Insull; "Similar Regional Review for Pacific States," John B. Miller.

Division II—Power Production

SECTION B—WATER-POWER PRODUCTION

Austria.—"Recent Practice in Civil Engineering with Reference to Water-Power Production," Oberbaurat Ing. Karl Innerebner; "Progress in Mechanical Engineering with Reference to Power Production," Verband der Deutsch-Oesterreichischer Maschinen-industrie.

Canada.—"Water-Power Production," H. G. Acres.

Dutch East Indies.—"General Principles and Conditions of Water-Power Production in the Dutch East Indies," Prof. J. N. Van der Ley; "Special Conditions of Civil Engineering Features of Water-Power Development in the Dutch East Indies," W. Blaser.

Great Britain. — "Problems Relating to Run-Off Storage, and the Allocation of Catchment Areas in Great Britain and Ireland," W. J. E. Binnie; "Factors of Efficiency in Hydro-Electric Development," Col. C. M. Norrie.

Italy.—"Recent Developments in Dam Construction in Italy," Ing. L. Mangiagalli; "Recent Developments in Italian Water Turbines," Ing. Ucelli; "The Continuity and Regularity of Operation of Large Electric Systems," Ing. Guido Semenza; "The Coexistence of Hydro-Electric and Steam-Driven Generating Stations as Affecting the Economy of Production and the Necessities of Storage and Reserve," Prof. G. Motta.

Norway.—"Electrical Supply of the City and Peninsula of Bergen," Asbj. Bjerke and E. Monsen; "Electrical Supply of Christiania," R. Steen; "Ice Troubles in Norwegian Rivers," A. Ruths.

Spain.—"Characteristics and Brief Description of the Scheme for Developing Hydraulic Power from Two Important Groups of Waterfalls in the Basin of the Duero," José Orbegozo; "Elimination of Vegetable Matter Carried in the Canal Water," Cornelio Arellano; "Elimination of Mineral Matter Carried in the Canal Water," Cornelio Arellano; "Canals on Sloping Ground," Emilio Arazola; "Some Features of Modern Hydro-Electric Developments," Diego Mayoral.

Sweden.—"General Conditions of Water-Power Development in Sweden," A. Ekwall; "Recent Practice in Swedish Water-Power Engineering," A. Westerlind; "Recent Practice in Lake Storage and What the Storage Means to Water-Power Utilization in Sweden," Gottfried Berg; "Measures Taken in Sweden Against Ice Troubles in Water-Power Plants," A. Frey Samsioe; "Recent Swedish Arch-Dam Design," Bc Hellstrom; "Modern Tendencies in Waterwheel Design," Prof. Hi. O. Dahl; "Planning of Hydro-Electric Plants with Regard to Reliable Operation," K. E. Nylander.

United States.—"General Review of Current Practice in Water-Power Production," John R. Freeman; "Relation of Power Development and Irrigation Upon the Same Streams," Henry J. Pierce; "Power Development on Navigable Rivers," Hugh L. Cooper; "The Design and Construction of High Dams," A. P. Davis; "The Design of Waterwheels and Control Equipment."

SECTION C—PREPARATION OF FUELS

Austria.—"Complete Gasification of Coal," Prof. Dr. Hugo Strache; "Testing Department for Fuels, Technical College, Vienna," Prof. Dr. Hugo Strache; "Heat Economy in Austria," Gesellschaft für Wärmewirtschaft, Vienna.

Great Britain.—"The Winning and Utilization of Peat," Prof. Pierce F. Purcell; "The Combustion of Powdered Coal in Cement Rotary Kilns," Dr. C. Martin; "The By-products of Coal Distillation in Relation to Power Production," W. G Adam; "Coal Treatment and Carbonization with Special Reference to Low-Temperature Methods," Prof. H. E. Armstrong; "The National Economic Power of Solid Fuel in Relation to Its Scientific Utilization, with Special Reference to Fuel in Pulverized Form," Leonard C. Harvey.

Holland.—"Oil Refining," C. J. M. Milo.

Sweden.—"Preparation of Fuels in Sweden," Dr. A. F. Enstrom; "Sawmill Waste as a Fuel." Otto Nordstrom; "Power from the Wood Waste of the Swedish Forests," Dr. H. von Eckermann; "A New System of Oil Production from Swedish Oil Shale," S. P. Bergh.

United States.—"Preparation of Fuels," C. F. Hirshfeld.

SECTION D—STEAM-POWER PRODUCTION

Austria.—"The Reciprocal Utilization of Waste Energy," Oberbaurat Ing. Bernhard Moritz Gerbel, Vizepräsident der Ingenieurkammer.

Canada.—"Carbo-Power Production," B. F. Haanel.

Great Britain.—"Steam Generation," Sir James Kemnal; "Steam Turbines," Sir Charles Parsons; "The Measurement of High Temperature and Its Importance in Fuel Economy," Sir Robert Hadfield; "Coke for Steam Raising," E. W. Nicol; "Fuel Conservation and Smoke Abatement," F. W. Goodenough.

Holland.—"Steam Turbines for High Pressures," C. F. Stork.

Sweden. — "Outstanding Features of Swedish Practice in Steam-Power Production," H. Lundberg; "Some Points with Reference to Combustion Economy," O. Rodhe; "Steam Generation at Extra High Pressures," I. V. Blomquist; "High-Pressure Water-Tube Boilers," O. A. Wiberg; "Steam Accumulation," Dr. J. Ruths; "Recent Development in the Construction of Steam Turbines," O. A. Wiberg; "Extra-High-Pressure Steam Turbines," P. Nordstrom; "Air Pre-Heating," Fr. Ljungstrom.

United States.—"General Review of Current Practice," Col. Peter Junkersfeld and George A. Orrok; "Boilers," D. S. Jacobus; "Steam Turbines," W. L. R. Emmet; "High Pressure and Superheat," W. S. Monroe.

SECTION E—INTERNAL-COMBUSTION ENGINES

Great Britain.—"Internal Combustion Engines," James Richardson; "Gaseous Explosions," Prof. R. V. Wheeler; "The Gas Producer as Applied to Large-Scale Power Generation," A. H. Lymn; "The Gas Turbine," A. H. Lymn and H. Holzwarth; "Gas Engines."

Italy.—"Large Internal-Combustion Engines," Ing. G. Tosi; "Internal-Combustion Engines for Motor Transport and Aviation," Sen. G. F. Agnelli.

Sweden.—"Review of Internal-Combustion Engine Development in Sweden," Prof. E. Hubendick; "Diesel Engines," K. J. E. Hesselman; "Hot-Bulb and High-Compression Engines," G. Dillner; "Carburetor Engines," Prof. E. Hubendick; "Gas Engines," Prof. E. Hubendick.

United States.—"Present Status of Internal-Combustion Engine in America," Dr. Charles F. Lucke.

SECTION F—POWER FROM OTHER SOURCES

Denmark.—"Utilization of Wind Power in Denmark": (a) "Meteorological Data," Prof. E. Schou; (b) "Modern Types of Windmills," P. Vinding.

Italy.—"The Larderello Natural Steam Plant," Prince Piero Ginori Conti.

Division III—Power Transmission and Distribution

SECTION G

Austria.—"Modern Practice in Power Transmission and Distribution in Austria," Direktor Ing. Ludwig Kallir.

Belgium.—"Production et Distribution de l'Energie Electrique en Belgique," M. Moreau.

Canada.—"Power Transmission and Distribution," Julian C. Smith.

Denmark.—"Transmission of Power from Norway to Denmark," A. R. Angela and Prof. William Rung.

Dutch East Indies.—"General Principles of Power Transmission in the Dutch East Indies—Interlinking of Power Stations," Prof. J. N. Van der Ley; "High-Tension Transmission Lines in the Dutch East Indies," W. Nobel.

France.—"Lignes Electriques de Jonction," M. Maroger; "Les Grandes Lignes de Transmission d'Energie Electrique à Très Haute Tension en France," M. J. Tribot Laspière.

Great Britain.—"The Transmission and Distribution of Electrical Energy," C. H. Merz; "High Voltage Direct-Current Generation and Distribution of Electrical Energy," J. S. Highfield and W. E. Highfield," "High-Voltage Underground Cables," L. B. Atkinson; "Loading Limits for Electric Power Cables—Some Recent Researches," E. B. Wedmore; "Power-Factor Improvement," Prof. Miles Walker; "Large Generators," A. B. Field; "Mechanical and Hydraulic Variable Transmission of Power," Dr. H. S. Hele-Shaw; "Power Transmission and Distribution by Means of Gas," Dr. E. W. Smith.

Holland.—"Application of Squirrel-Cage Induction Motors with Special Starting Characteristics," A. Brunt; "Iron-Clad Switchgear," H. A. Hidde Nijland; "Recent Developments in Power-Station Design in the Netherlands," J. J. L. Smits; "The Electrification of the Netherlands," F. A. Smit Kleine and High-Tension Committee, Vereeniging van Directeuren van Electriciteitsbedrijven in Nederland.

Italy.—"Recent Electrical Developments in Overhead Transmission Lines," Ing. U. del Buono; "Recent Mechanical Developments in Overhead Transmission Lines," Prof. G. Rebora; "The Limits of Extension in the Parallel Operation of Electric Systems with Special Reference to Economy and Service," Ing. R. Norsa; "Electric Cables for Extra High Tensions," Ing. L. Emanueli.

Norway.—"Determination of Efficiency and Phase Displacement in Transformers by Measurement on Open Circuit and Short Circuit," Prof. O. S. Bragstad; "The Influence of Voltage Regulation on Electricity as a Product of Quality—Proposal for International Rules of Voltage Regulation," Prof. Fr. Jacobsen.

Spain.—"Network of National High-Tension Lines," Luis Sanchez Cuervo; "Description of the System of Generating, Transmitting and Distributing Electricity in Catalonia," Catalana de Gás y Electricidad S. A.; "Considerations Affecting the Interconnection of Existing Transmission Systems," Claudius E. Bennett.

Sweden.—"Recent Developments in Alternating-Current Generator Design," R. Liljeblad; "Recent Practice in Transformer Construction," K. E. Eriksson; "Economic and Technical Organization of Large-Scale Power Distribution," W. Borgquist; "Technical and Administrative Systems for Rural Electrification in Sweden," N. Ekwall; "Low-Tension Distribution and Electric Storage," C. Rossander; "Design and Standardization of Transformers," A. Ytterberg.

Switzerland. — "High-Voltage Power Transmission."

United States.—"Power Station Electrical Equipment," B. G. Lamme; "The Technical Problems of High-Tension Electric Power Transmission," F. G. Baum; "Economics of Power Development in Large Stations Interconnected Into a Single Superpower System," W. S. Murray.

Division IV—Utilization of Power

SECTION H—POWER IN INDUSTRY AND DOMESTIC USE

Canada.—"Utilization of Power," P. T. Davies.

Denmark.—"Technical Development and Financial Organization, Including Co-operative Schemes, for Electricity Supply in Denmark," F. H. Krebs; "Technical Development of Low-Tension Distribution Lines, and the Execution of House Installations," V. Faaborg Andersen.

Great Britain.—"Some Notes on the Future of Electrical Supply and Demand," Sir Alexander Kennedy; "Electro-Farming Economics," R. Boriase Matthews; "Industrial Use of Gas," Sir Arthur Duckham; "Science in the Gas Industry—Present, Past and Future," Prof. J. W. Cobb; "The Present Position and Future Prospects of the Gas-Making Industry," D. Milne Watson.

Holland.—"Development of the Use of Electricity for Domestic Purposes," Dr. W. Lulofs.

Norway. — "Electrical Power in Norwegian Households," J. Sandberg; "Electricity Rates in Norway," Joh. A. Haga.

Sweden.—"Power Saving Through Anti-Friction Bearings," Uno Forsberg; "Electricity in Agriculture," N. Ekwall.

Switzerland.—"Power in Agriculture"; "Domestic Uses of Power."

United States.—"Electric Power in Steel Mill Operation," B. H. Shover; "Electric Power in the Textile Industry," Charles T. Main; "Electric Power in the Paper Industry," H. H. White.

SECTION J—POWER IN ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY

Austria.—"The Austrian Electrochemical Industry, with an Appendix Upon the New Institute for Technical Electrochemistry at the Technical College, Vienna," Prof. Dr. Heinrich Paweck.

Great Britain.—"Electrolytic Iron," T. W. S. Hutchins; "Electrostatic Precipitation," Sir Oliver Lodge.

Italy.—"Electrometallurgy in Italy," Prof. F. Giolitti.

Sweden.—"The Electrochemical Industry in Sweden," Prof. W. Palmaer; "A New Resistance Furnace with Reaction Zone," T. Holmgren.

United States.—"General Review of Electrochemical Progress and Processes in the United States," F. C. Fitzgerald; "Electric Power in Metallurgy," Frederick Laist.

SECTION K—POWER FOR TRANSPORT

Dutch East Indies.—"Electrification of Railways in the Dutch East Indies," Dr. G. De Gelder.

Great Britain.—"Application of Power to Rail Transport," Roger T. Smith and C. B. Collett; "Power Applied to Road Transport," Col. R. E. B. Crompton; "Application of Power to Sea Transport"; "Shipowners and Shipbuilders," Viscount Inchcape; "Sail—Its Early History and Later Development," Basil Lubbock; "Steam and the Measurement of Power," Hector C. Bywater; "Hull Resistance and Power for Propulsion," G. S. Baker; "Sea Speeds and Their Costs," Alexander Gray; "Fuels and Their Supply," F. J. Leathers; "The Development and Present Position of the Motor Ship," A. P. Chalkley; "The Marine Diesel Engine—Its Origin, Development and Future," F. E. Rebbick; "Two-Cycle Diesel Engines," Robert Traill; "Diesel Auxiliary Machinery in Connection with Marine Propulsion," Richard W. Allen; "Electric Transmission of Power for Propelling Machinery," W. J. Belsey; "Résumé," F. A. Hook; "Application of Power to Air Transport," A. Ogilvie.

Holland.—"Some Considerations on Traction for Railways and Tramways," Prof. Ir. I. Franco; "General Data on the Propulsion of Oceangoing Ships in Holland," Ir. W. J. Muller.

Italy.—"Electric Traction in Italy," Prof. Ing. F. Tajani.

Sweden.—"Power Problems of the Swedish Railways," I. Ofverholm; "Power Questions Relating to Swedish Tramways," A. Hultquist; "Power for Water Transport in Sweden," H. Hammar; "The Reversing-Clutch Marine Turbine," O. A. Wiberg.

Switzerland.—"Railway Electrification."

United States. — "Railroad Electrification," Bion J. Arnold; "Electric Ship Propulsion," Commander Robinson, U.S.N.

SECTION L—POWER FOR ILLUMINATION

Great Britain.—"Progress in Electrical Illumination," C. W. Sully, Electric Lamp Manufacturers' Association of Great Britain; "National and International Aspects of Illuminating Engineering," L. Gaster; "International Co-ordination in Illumination," J. W. T. Walsh.

Holland.—"Some Modern Points of View Concerning the Construction of Electric Incandescent Lamps," Dr. Ing. N. Halbertsma.

Division V—General

SECTION M—ECONOMIC, FINANCIAL AND LEGAL

Dutch East Indies.—"Legislation for Electricity Supply in New Countries," Prof. J. N. van der Lev.

France.—"Législation des Forces Hydrauliques en France," M. Arbelot.

Great Britain.—"The Financial Aspect of Hydro-Electric Development," George Balfour, M.P.; "The Effect of Depreciated Currencies and International Financial Conditions on Power Development Within the British Empire," Sir Ernest Harvey; "Government, Co-operation in Power Development Within the British Empire," Sir Philip Lloyd-Greame, M.P.; "The Economics of World Power," Sir Philip Nash.

Holland.—"Executive and Administrative Interest by Public Authorities in the Supply of Electricity in the Netherlands," J. G. Bellaar Spruyt and E. A. Schoon.

Norway.—"Export of Electrical Power," S. Kloumann; "Synopsis of Norwegian Water Power and Electricity Acts," H. Larsen; "The Financing of Loans for Power Development," M. Stuevold-Hansen.

Sweden.—"Power Policy," C. Kleman.

United States.—"Government Policies Best Adapted to Promote Power Development," Herbert Hoover, Secretary of Commerce; "Private Versus Public Ownership and Operation," Arthur T. Hadley; "Financing of Power Development in the United States," S. Z. Mitchell; "Relation of Power Development to Industrial and Economic Progress," Guy E. Tripp; "Power Development from the International Standpoint," Owen D. Young; "Policy and Practice in the United States in the Future Regulation of Public Utilities," Carl D. Jackson.

SECTION N—RESEARCH, STANDARDIZATION, EDUCATION, HEALTH, PUBLICITY, ETC.

Austria.—"The Influence of Large Water Power Installations on the Régime of Flow," Prof. Dr. Ing. Friedrich Schaffernak; "Divining Measurements by Means of the Torsion Balance in Austria," Hofrat Prof. Dr. Richard Schumann; "Electro-Aëronautic Research Work," Generaldirektor Ing. Oskar Taussig; "Health Conditions and Welfare Work in Austria," Sektionsrat Dr. Ernst Brezina and Ministerialrat Dr. Mumelter; "International Co-operation in Technical Work," Ing. Dr. Wilhelm Exner; "Austrian Laboratories for Technical Research and the Testing of Materials," Technisches Versuchsamt im Bundesministerium für Handel und Verkehr; "Rivers as Factors of Energy," Ing. Edward Suess; "Standardization in Austria," Oesterreichischer Normenausschuss für Industrie und Gewerbe.

Dutch East Indies.—"Electrical Standardization in the Dutch East Indies," C. D. Volker.

Great Britain. — "Standardization, National and International," C. Le Maistre; "The Education of the Apprentice," Prof. A. P. Lawrie and Prof. F. G. Baily; "The Education and Training of the Engineer of the Future," A. P. M. Fleming; "Broadcasting—the New Influence," J. C. W. Reith; "The Importance of Greater Public Interest in Mechanical Progress," T. C. Elder; "The Place of Publicity in the Public Service of Electricity Supply," J. W. Beauchamp; "Man in Relation to Production," D. R. Wilson; "The Resources of the British Empire in Metals Used in the Manufacture of Machinery," Prof. Henry Louis; "Alcohol as a Source of Power," Sir Charles Bedford; "Some Power Areas in the British Empire and Their Possibilities from the Point of View of Industrial Development," R. P. Wilson.

Holland.—"Some Notes on Power Stations Running in Parallel," Ir. G. J. Th. Bakker and Ir. J. C. van Staveren; "Considerations as to the Most Economical Ratio of Increase in a Series of Standardized Main Dimensions," Dr. Ir. J. Goudriaan; "The Education of the Engineer in the Netherlands and Its Colonies," Prof. L. A. Van Royen; "Psychotechnics in the Netherlands," J. L. Prak.

Norway.—"Proposal for Uniform Rules for Testing Water-Power Plants," Prof G. Sundby; "Desirability of Standardizing Electrical Household Appliances," H. Grosch.

Sweden. — "Organization of Research Work in Sweden," Dr. A. F. Enström; "Industrial Standardization in Sweden," A. Kruse; "Elementary Engineering Education," N. Fredriksson; "Advanced Engineering Education," H. M. Pleijel; "Education for Commerce," Prof. C. Hallendorf.

United States.—"New Fields for the Development, Distribution and Utilization of Power in Which Research Should Be Vigorously Conducted," E. W. Rice, Jr.; "International Standardization in the Field of Power," S. W. Stratton; "The Social Aspect of Power Development," F. R. Low; paper by Julius Barnes.

Briefer News

Tacoma Electric Club Reorganized.—The Electric Club of Tacoma, Wash., has recently been reorganized, with the following officers: Charles Stewart, president; Frank Muehlenbrush, treasurer, and Carl Jebbers, secretary.

Citizens' Light & Power Company, New Orleans, Is Reorganized.—Announcement is made that as a result of acquisition of control by the former minority stockholders the Citizens' Light & Power Company, which operates in the Carrolton section of New Orleans, has been reorganized with L. S. McHenry of Louisville as president and that plans for expansion are under way.

Cleveland Meeting of A. S. M. E..—The spring meeting of the American Society of Mechanical Engineers, to be held at Cleveland on May 26-29, will have as one feature a paper by W. L. R. Emmet, consulting engineer of the General Electric Company, on the mercury-vapor process. A joint session with the American Society for Testing Materials will discuss the properties of materials at high and low temperatures. The power division will stress the power problems of the steel industry.

Progress of Salt Creek Oil-Pumping Project.—The Midwest Refining Company, which, as announced last November, plans to construct a great electric plant for oil-pumping purposes at Shannon, Wyo., in the heart of the Salt Creek oil fields, with natural gas for fuel, expects that the first unit of the plant will be ready for operation late this year or early in 1925. It will take several years to complete the project, which will be, it is said, the largest electrically operated oil field in the world.

Railroads Ordered to Electrify in Yonkers and Mount Vernon.—Governor Smith of New York has signed a bill amending the Public Service Commission law so as to require the electrification of all railroads within the limits of a city adjoining the city of New York before the first day of January, 1926. The section requiring the electrification of all railroads in Greater New York became a law in 1923. The amendment to the law affects the cities of Yonkers and Mount Vernon.

Purchasing Agents' Association Has Public Utility Group.—The program of the convention of the National Association of Purchasing Agents, which is to meet at Boston on May 20-23, will this year include proceedings for the especial benefit of the newly formed group of public utility purchasing agents. This group is to be composed of representatives of all types and kinds of public utilities throughout the United States and is confidently expected by its promoters to become a strong factor in public utility work.

Wabash River Plant to Be Enlarged.—The installation of a third 20,000-kw. turbo-generator unit at the Wabash River steam plant of the Indiana Electric Corporation, with the necessary auxiliary equipment, has been authorized, and the work will be done as soon as possible by Stone & Webster, Boston, the designers and builders of the original station.

New Hampshire Has Mile-Long Penstock.—The electrical energy supply of Keene, N. H., and neighboring towns is to be supplemented by a water-power development just completed on the Minnewawa River at Marlboro, N. H. Here an arch dam, the first structure of that type to be erected in that section of the country, has been built to impound water from ponds covering 1,500 acres. The dam is 60 ft. high and 145 ft. in length at the crest and is built across a valley with sides of solid granite. A drop of 276 ft. to the power

house is afforded. The penstock is made of California redwood, is 4 ft. in diameter and is supported on cement cradles for a distance of 5,700 ft. to the power house. A spillway takes care of excess water going over the top of the dam during the spring freshets. A transforming station has been erected at Keene. The initial installation will have a capacity of 2,500 hp., and twelve towns can be supplied with electric power through this source.

Merchants' Heat & Light Gets Indianapolis Street-Lighting Contract.—A contract for lighting Indianapolis for ten years, beginning April 1, 1925, has been awarded by the Board of Public Works to the Merchants' Heat & Light Company. Figures tabulated by the city engineer showed the company's bid was $1,131,600 lower for the ten-year period than that submitted by the Indianapolis Light & Heat Company. The total contract price for the ten years will be between $3,500,000 and $4,000,000. The downtown column lights are to be replaced with others which will have six times as much candlepower.

Two Doherty Kansas Properties Sold.—The United Water, Gas & Electric Company of Hutchinson, Kan., and the Salina (Kan.) Light, Power & Gas Company, both formerly controlled by the Cities Service Company of New York, have been sold to the United Power & Light Corporation.

Extending Staten Island's Electric System.—The Staten Island Edison Corporation of St. George, N. Y., has awarded a contract to the J. G. White Engineering Corporation for the construction of a 33,000-volt power transmission line from the Livingston power house to Eltingville, Staten Island, about 8 miles distant, and for outdoor substations at Livingston and Eltingville. Staten Island, or Richmond Borough, is a part of New York City.

Two Radio Programs Sent Over Light Wire.—Engineers of Wired Radio, Inc., a subsidiary of the North American Company, have succeeded in sending two "wired radio" programs successfully over the same electric wire and are now, it is claimed, certain of being able to send three programs simultaneously over the same wire. This is a development of the "wired-wireless" invention of General George O. Squier for transmitting radio over light and power lines, with which Wired Radio, Inc., has been carrying on extensive experimental and pioneer work on Staten Island, N. Y.

Kentucky-Tennessee Power Company Takes Over a Municipal Plant.—The city of Martin, Tenn., has just entered into a conditional contract with the Kentucky-Tennessee Power Company whereby the city agrees to dispose of its power plant and lines to the company for $82,775. The power company agrees to put into effect at once an approximate reduction of 40 per cent of present power rates and to furnish the city with power and light at the rate of 3 cents a kilowatt-hour. A high-tension line will be run direct to Martin, which, if the company's plans are carried out, will be the distributing point to a group of about ten towns.

Montgomery's New "White Way."—A "white way" lighting system was recently brought into service at Montgomery, Ala., amid a general celebration of citizens. In the immediate downtown district formerly served by twelve arc lamps with a total rating of 6,900 cp. steel poles have replaced wooden ones and 122 lamps giving 130,000 cp., or nearly twenty times as much light, have been installed. This great improvement has followed the acquisition of the Montgomery central station by the Alabama Power Company, which has also wrought a vast improvement in the business section by removing a network of overhead wires and burying them under the streets.

Utah Engineering Council Holds Banquet.—The annual banquet of the Engineering Council of Utah was held at the Hotel Utah at Salt Lake City on the evening of April 28, with an attendance of about 250. Carl E. Grunsky, president of the American Society

of Civil Engineers, read a paper on "The Influence of Engineering Upon Social and Economic Progress," in which he pointed to the predominant influence of electricity in modern life. R. K. Brown, president of the Engineering Council of Utah, made his annual report. D. C. Green, vice-president and general manager of the Utah Power & Light Company, acted as toastmaster.

San Francisco Companies Divide Purchased Utility Equally. — The Great Western Power Company and the Pacific Gas & Electric Company have applied to the California Railroad Commission for permission to divide the properties formerly owned and operated by the Universal Electric & Gas Company in the city and county of San Francisco upon an equal basis and to operate the same as parts of their respective territories. The application recites that on June 1, 1922, the Pacific Gas & Electric Company paid to the Great Western Power Company of California the sum of $1,127,303, or one-half of the purchase price of the property of the Universal Electric & Gas Company, and that since March, 1922, the Great Western Power Company of California has operated the properties now divided equally between the two companies.

New Hydro-Electric Project for Northeastern Oklahoma. — A large hydro-electric power plant which will generate a minimum of 16,000 hp. is planned by the Public Service Company of Oklahoma for construction on the Grand River just below Grove. A preliminary permit from the Federal Power Commission has been applied for, and as soon as it is granted a survey will be begun. This preliminary work will require about a year. The plant, if constructed, will be the largest of its kind in the state and will supply electricity to cities and towns in eastern and northeastern Oklahoma. The preliminary plans call for a dam with minimum height of 40 ft., thus creating a large artificial lake. Power from the plant will be fed into the system which supplies Vinita and surrounding territory. The cost of the project has not yet been estimated.

Columbus, Ohio, Tries Forty-four Types of Street Lighting.—Instead of sending a committee on a junketing trip around the country to inspect street-lighting systems, Columbus, Ohio, recently determined to have experimental systems installed in the city itself, where the people could see and judge them. As a result the General Electric and other companies have operating on exhibition thirty-two different kinds of street lighting, which added to twelve kinds previously in use makes a total of forty-four. For the "white way" six twin-unit ornamental luminous arcs have been installed. Similar lamps on different-type standards are being exhibited on one of the better residential streets. For the other exhibits single and two-unit standards with incandescent lamps ranging from 500 cp. to 1,500 cp. are used. The experimental systems are expected to remain until the city has definitely chosen between them.

"Safety-Educational Rally" in New York.—More than a thousand superintendents and foremen attended an enthusiastic "safety-educational rally" held at the Engineering Societies Building, New York, on May 2, under the auspices of the Metropolitan New York Section of the N. E. L. A. W. E. Sanford, chairman of the section's committee on safety rules and accident prevention, presided, and speeches were made by Frank W. Smith, former president of the N. E. L. A.; Arthur Williams of the New York Edison Company, who is president of the American Museum of Safety; A. J. Van Brunt of the American Society of Safety Engineers, and C. B. Scott of the Bureau of Safety, Chicago.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Association of Purchasing Agents — Mechanics' Hall, Boston, May 20-23.

National Electrical Credit Association —Congress Hotel, Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

American Society of Mechanical Engineers — Spring meeting, Cleveland, May 26-29. C. W. Rice, 29 West 39th St., New York.

Electric Power Club — Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association —Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Northeastern Division, A. I. E. E.—Polytechnic Institute, Worcester, Mass., June 5-6.

American Association of Engineers—San Francisco, June 11-13. C. E. Drayer, 63 East Adams St., Chicago.

Canadian Electric Association—Ottawa, Ont., June 11-13. Louis Kon, 311 Power Bldg., Montreal.

North Central Division, N. E. L. A.—Winona, Minn., June 11-13. H. E. Young, Minneapolis General Electric Company, Minneapolis.

Arkansas Utilities Association—Hotel Eastman, Hot Springs, Ark., June 12-14. R. I. Brown, Arkansas Central Power Company, Little Rock.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 16-20. Frederic Nicholas, 30 East 42d St.

American Society of Civil Engineers—Pasadena, Cal., June 16-20.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Georgia Electrical Association—East Lake Country Club, Atlanta, June 18-19. W. C. Drake, 75 Marietta St., Atlanta.

Empire State Gas and Electric Association—Commercial Section, Buffalo and Niagara Falls, June 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Wyoming Utilities Association—Casper, Wyo., June 23-24. H. C. Chappell, Natrona Power Company, Casper.

American Institute of Electrical Engineers — Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 23-27.

Iowa Section, N. E. L. A.—Wahkonsa Hotel, Fort Dodge, June 24-26. M. G. Linn, Des Moines Electric Co., Des Moines.

American Society for Testing Materials—Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-27.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Northwest Electric Light and Power Association—Gearhart Hotel, Gearhart, Ore., June 25-27. G. H. Gueffroy, Pacific Power & Light Company, Portland.

El Paso Installs Arc Lamps, Finding Radio "Fans'" Opposition Ill Founded. —The City Council of El Paso, Tex., has approved the installation of an arc-lighting "white-way" system in that city, despite the opposition of radio enthusiasts, who, as recorded in these columns a few weeks ago, maintained that arc lighting would interfere with wireless reception. A committee of engineers reported that "the arc light is best adopted for the system proposed and offers the most light for the money," and the contention of P. A. Tracy, a radio expert, that arc lights and arcs from electrical appliances are the chief cause of air disturbances was vigorously contested by C. A. Winder of the General Electric Company, who declared that, whatever the old type of arc lighting did, "the new luminous-arc light does not break its contact and cause electrical disturbances."

Indianapolis Companies Accused of Granting Rebates to Power Customers. —Suits against the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company asking that heavy fines be assessed against the companies on account of alleged violations of the state law prohibiting granting of special rebates to favored customers were filed in the Circuit Court in Indianapolis on May 9 by the attorneys for the Indiana Public Service Commission and the Attorney-General of Indiana. The action of the commission follows an investigation of more than a year and a half of alleged discrimination by the companies in fixing demand charges of large users of electric power. Attorneys for the two companies said they could issue no statement until the complaint had been thoroughly studied. Possible fines reaching $100,000 are said to be involved if the suits go against the defendants and the maximum penalty in every case is assessed.

National Electrical Credit Association Program.—At the Chicago convention of the National Electrical Credit Association, to be held at the Congress Hotel May 22 and 23, the "Milwaukee plan" of turning contractors into business men will be discussed at the first morning session. On the second morning T. J. Whearty, National Carbon Company, will give a paper on radio credits and collection problems; L. W. Lyons, Westinghouse Electric & Manufacturing Company, one on credit policies, and H. A. Lewis, business manager *Electrical Merchandising*, will tell how credit managers can improve conditions within the industry. In the afternoon Mrs. E. A. H. Beck, Chicago, will discuss the relationship between manufacturers and customers, and there will be a debate on the question, "Are present electrical channels of distribution of household appliances to survive the competition of non-electrical jobbers and dealers?" Other general discussions will take place.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

A. S. Huey Board Chairman for Byllesby Interests

Arthur S. Huey, the new chairman of the board of H. M. Byllesby & Company, has been vice-president in charge of the operation and management of this company's public utilities throughout the United States for many years. Mr. Huey's first connection with the electrical industry was in 1885, when he was appointed a representative of the Edison Company (manufacturing) at Minneapolis. Seven years later, after the consolidation of the United Edison Company with the Thomson-Houston Company, he became identified with

A. S. HUEY

the Northwestern General Electric Company at St. Paul and was for a long period in charge of that office. Through it was distributed much of the electrical generating machinery used in the early central stations of Minnesota, Wisconsin and the Dakotas. Subsequently Mr. Huey was interested in the pioneer manufacturing of electric vehicles. When the present firm of H. M. Byllesby & Company was organized in 1902 Mr. Huey was one of the original partners, and as vice-president he took charge of the department of operation and management, in this latter capacity directing and supervising the operation of about twenty groups of utility properties. His career as a public utility operator and manager has been conspicuously successful. His views on establishing friendly relations between the utilities and the public, expressed in addresses he made a number of years ago, have had a large circulation in printed form.

Mr. Huey's recent election includes the occupancy of the same office in the Standard Gas & Electric Company and the Northern States Power Company.

Samuel Insull, Jr., has been made a member of the board of directors of the Middle West Utilities Company, succeeding Charles A. Munroe, resigned.

B. E. Sunny has been made a member of the executive committee of the Middle West Utilities Company, succeeding Charles A. Munroe, resigned. Mr. Sunny is a member of the company's board of directors.

H. T. East has recently joined the staff of Vice-President Charles W. Bradley of the Public Service Company of Northern Illinois as service engineer. Mr. East brings to his new position the results of eight years' experience as a service engineer, specializing in public relations and kindred matters.

Charles L. Cadle, formerly consulting engineer of the Rochester (N. Y.) Gas & Electric Company, was made assistant general manager of the company at a recent meeting of the board of directors. Mr. Cadle, who is a graduate of the Case School of Applied Science, Cleveland, has had much experience in utility work.

Gano Dunn, president of the J. G. White Engineering Corporation, was elected chairman of the National Research Council on April 27. Another honor conferred recently on him was election to membership in the American Philosophical Society. Mr. Dunn, who was reported to have left for Europe in the May 10 issue of the ELECTRICAL WORLD, was forced to cancel his booking just previous to sailing owing to the unexpected pressure of business. He is planning to sail within a week or two.

Lawrence A. Coleman, treasurer of the United Electric Light & Power Company, New York City, has been recently elected to the board of directors of that organization. Mr. Coleman was first employed by the company in 1891 as an office boy and in the space of thirty-three years has served in numerous capacities. In 1919 he was elected treasurer. In past years, while in the department of accountancy and later as assistant secretary, he was actively identified with N. E. L. A. educational developments and as treasurer he has been associated in a prominent degree with accident prevention and public relations activities within and beyond his company.

Julius Daniels, new chairman of the Commercial Section of the New England Division of the N. E. L. A., is well known among central-station men of the Northeast for his work in the field of illumination. He worked in the laboratory of the Edison Electric Illuminating Company of Boston for about eighteen months before the war and afterward was closely associated with the late Dr. Louis Bell in the latter's investigations for this utility. He joined the sales department of the Boston company in 1919 and shortly afterward the present division of illuminating engineering was organized with Mr. Daniels at its head. He has continued in charge of this work since with the title of illuminating engineer. He has been chairman of the lighting division of the Commercial Section, New England Division, N. E. L. A., secretary of the New England Section, Illuminating Engineering Society, and has had charge of the Bureau for Better Illumination at Boston in co-operation with the Massachusetts Institute of Technology.

J. J. O'Brien New President of Byllesby & Company

John J. O'Brien, recently elected president of H. M. Byllesby & Company and the Byllesby Engineering & Management Corporation, had been associated with the late Colonel Byllesby since the inception of the organization

J. J. O'BRIEN

in 1902, when he became treasurer and general auditor of the newly formed H. M. Byllesby & Company. He has been a vice-president for many years in charge of financing. Virtually Mr. O'Brien's entire business career has been connected with the electric industry. His first position was with the Pullman Company in 1887, but two years later he joined the United Edison Manufacturing Company, subsequently known as the Edison General Electric Company. In 1892 this company was consolidated with the Thomson-Houston Electric Company, forming the present General Electric Company. Mr. O'Brien was in charge of accounting in the Chicago office of this company when he left, in 1902, to join Colonel Byllesby. Mr. O'Brien is a native of Chicago and was educated in the public schools of that city and at a business college.

Clark H. Minor, formerly European sales manager of the Western Electric Company, has been elected a vice-president of the International General Electric Company. Mr. Minor has been identified with the Western Electric Company since 1902 and after occupying various clerical positions served as

assistant manager and manager of the Kansas City office and manager of the Omaha office, later going to Antwerp as manager of the Belgium branch. In 1914 he returned to this country and became acting foreign sales manager in New York City. He was assigned in 1918 to special work in China and Japan, under the supervision of Gerard Swope, organizing in that year the China Electric Company, Ltd., for the purpose of manufacturing telephone apparatus. It was in 1921, after completing his work in the Orient, that he became European sales manager.

G. W. Fry Heads Southwestern Association

G. W. Fry, president of the West Texas Utilities Company, Abilene, Tex., was elected president of the Southwestern Public Service Association at its recent convention in New Orleans. Prior to becoming president of the West Texas company, he was vice-president and general manager of the Abilene Gas & Electric Company, which is now merged with other companies into the West Texas company. Mr. Fry came into the electrical field from the steam-railroad business. He is primarily an executive and organizer, distinguished among those who know him for the confidence he has inspired in his employees and the public. To him is also credited the saturation of small towns with utility securities to a degree never equaled before in the Southwest.

R. B. Bragg, manager of the Pasco-Kennewick district of the Pacific Power & Light Company, has been appointed manager of the company's office at Walla Walla. Mr. Bragg, who has been connected with the company for about ten years, is succeeding L. A. Safford, resigned.

H. M. Clayton, formerly assistant superintendent of light and power of the Arkansas Central Power Company, has recently become acting superintendent of distribution of that company. Mr. Clayton held his former position for about a year. In the year prior to that he was engaged in design work. For two years he was employed in meter testing.

W. G. Shurgar, assistant superintendent of power plants of the Arkansas Central Power Company for four years, is now superintendent of power plants. During the four years prior to the period 1916-1920, when he was engaged in independent civil-engineering work, Mr. Shurgar was employed as engineer with the Meridian Light & Power Company, a Doherty property.

N. P. Zech, formerly connected with H. M. Byllesby & Company, Chicago, and more recently identified with the General Engineering & Management Corporation and the Commonwealth Light & Power Company as vice-president and director, has become associated with A. E. Fitkin & Company, New York. During the past few years Mr. Zech has been in business for himself, engaging in corporate financing. His new duties are in connection with the operation of the Fitkin public utility and industrial properties.

J. V. Strange New Manager of Carolina Company

John V. Strange, assistant general manager of the Pacific Power & Light Company, with headquarters in Portland, Ore., became operating manager of the Carolina Power & Light Company, Raleigh, N. C., on May 1. For the past thirteen years Mr. Strange has been with the Pacific Power & Light Company and for five years has held the position of assistant general manager. Starting in 1911 in the stores department at Kennewick, Wash., he was stationed successively as local manager at Prosser, Wash., Hood River, Ore., and Pasco-Kennewick, Wash. At Raleigh he has assumed duties similar to the work he was engaged in at Portland. Mr. Strange is well known as a utility man in the Pacific Northwest, having been very

J. V. STRANGE

active in the Northwest Electric Light and Power Association. He was one of the sponsors of the electric range in this section and has served during the past year on the electric range committee of the Northwest association, which is to make a thorough survey of the entire range situation.

B. F. Tucker of Havana, Ill., who has been a utilities engineer and operator in the Middle West for many years, has been appointed to the newly created post of general superintendent established by the Beloit (Wis.) Water, Gas & Electric Company. Mr. Tucker will be placed in immediate charge of the operation, maintenance and construction of the company's electric, gas and water properties under the supervision of B. F. Lyons, vice-president and general manager.

Benjamin H. Glover, formerly associate electrical engineer of the Underwriters' Laboratories, Chicago, has been appointed engineer of equipment in charge of the recently established department of equipment. Mr. Glover has been identified continuously with the Underwriters' Laboratories since 1910, when he joined its forces after six or seven years of varied practical experience in electrical engineering. Many years ago he was connected with the laboratories, then known as the electrical bureau of the National Board of Fire Underwriters.

Berkeley H. Snow, district manager of the Pacific Power & Light Company at Hood River, Ore., has resigned to become Northwestern editor of the *Journal of Electricity,* a McGraw-Hill publication. Mr. Snow's headquarters will be in Portland, Ore.

R. B. Williamson, electrical engineer-in-charge of alternating-current design of the Allis-Chalmers Manufacturing Company, sailed recently for a two months' trip to the British Isles and the Continent. During his stay abroad Mr. Williamson will inspect European engineering developments and will attend the British Empire Exhibition.

Herbert J. Flagg, for four and a half years chief engineer of the State Department of Public Works at Olympia, Wash., has resigned to become assistant manager of the Grays Harbor Railway & Light Company in Aberdeen, Wash. Mr. Flagg was formerly assistant city engineer at McMinnville, Ore., and more recently city engineer for the towns of Dallas and Hillsboro, Ore. He assumed the duties of his new position on May 1.

Obituary

William McDevitt, chief inspector of the Philadelphia Fire Underwriters' Association, died last week. Mr. McDevitt was formerly chief of the electrical department of the Progressive Fire Underwriters' Association and had been identified with fire prevention work for more than half a century.

Judge Tully Scott, a member of the Colorado Public Utilities Commission since his retirement as Chief Justice of the Colorado Supreme Court, died on Sunday, May 4, at the age of sixty-seven. For the past ten months Judge Scott had been an inactive member, being too ill to perform his duties on the commission.

Herbert J. Desson, manager of the Detroit office of the Blaw-Knox Company, died on April 16 after a brief illness. Mr. Desson, a native of Cleveland, joined the Blaw-Knox Company in 1916 and three years later was placed in charge of the company's Detroit branch. He was forty-four years of age.

George F. Nevins, secretary and treasurer of the Pacific Power & Light Company, died in Portland, Ore., on Saturday, April 12. Mr. Nevins had a wide acquaintance among electrical men in the Northwest, having been particularly active in the Accounting Section of the Northwest Electric Light and Power Association. A native of Waterbury, Conn., he entered upon his career in the public utility field as an employee of the Southern Pacific Company in Texas and Louisiana. He engaged in railroad work for a number of years before affiliating himself with the Pacific Power & Light Company in 1910. Soon after he joined the company he was elected secretary and treasurer. Mr. Nevins was fifty-eight years of age.

Commission Rulings

Condemnation of Needless Delays in Presenting Briefs.—Overruling on the evidence the contention of the Renovo Central Labor Union that the rates of the Renovo Edison Light, Heat & Power Company were unjust and excessive, the Public Service Commission of Pennsylvania found fault with the parties to the case because of their dilatoriness in filing briefs, which, after repeated postponements, the commission dispensed with, saying that further indulgence was deemed futile, "however much they might have lightened the burden of the commission and have been helpful in its determination of these complaints. The commission is not disposed to close the door against reasonably necessary delays in the prosecution of complaints or the defence thereto," it continued, "but it is disposed to hold a stricter rule on inexcusable delays which needlessly hold up the work of the commission."

Consumer Who Fails to Select Best Operating Schedule Is Not Entitled to Reparation.—Failure to operate under the most favorable schedule was held by the Illinois Commerce Commission to be insufficient ground for awarding reparation in a complaint brought against the Commonwealth Edison Company by the Hydrox Company. The commission said that although the consumer did not operate during winter peak periods this was of no benefit to the utility, since the latter must stand ready to serve under the contract in force and actually receive little or no benefit from the curtailment of service. Regarding the failure of the utility and the consumer to enter into a contract more favorable to the latter the commission said: "Changes in amount or character of load are often made without the utility's knowledge. To hold the utility responsible for notifying all its consumers of the most advantageous rate and for following up matters to see that such rates are taken advantage of would be practically to guarantee that a consumer would be furnished service under the most favorable rate conditions. The utility should offer its advice in assisting the consumer to get a proper rate, but the choice of the optional rate must finally rest with the consumer. When a consumer is informed of available rates and is aware or may become aware through information reasonably available to him of the fact that he is entitled to a desirable rate, the commission is inclined to the opinion that there would be no further obligation on the part of the company to see that he takes advantage of it. Public utilities in Illinois must give general public notice of changes in rates, must file conspicuous notices that schedules of rates are open for inspection, must file rates with the commission, and are required upon request specifically to inform any consumer of the conditions under which he may receive efficient and economical service. To hold public utilities to the further obligation of seeking out every possible condition where a more advantageous rate may be secured would not appear reasonable."

Right of Utilities to Issue No-Par-Value Stock.—The question of the approval or disapproval of no-par-value common stock came before the New Jersey Board of Public Utility Commissioners for the first time in connection with the application of the Eastern New Jersey Power Company for authorization of its financial set-up. The board came to the conclusion that an electric light and power company formed under the general corporation act, although a public utility, has the right to issue no-par-value stock; but in order to carry out the purpose of an act passed in 1921 the board felt the necessity of stating the value of said stock, which it proceeded to do.

Recent Court Decisions

Judgment Not Recoverable Against County Which Has Exhausted Its Funds.—In Santa Fé Water & Light Company vs. Santa Fé County, a suit for unpaid bills, the Supreme Court of New Mexico held that a judgment cannot be rendered against a county for water and light furnished to be used at its court house, where the funds derived from its income for the current year during which such debts were created have been entirely exhausted and no money is available with which to pay the same. (224 Pac. 402.)*

Supreme Court Refuses Jurisdiction in Buffalo Suit Against Public Service Commission.—The United States Supreme Court has dismissed for want of jurisdiction, without a written opinion, the appeal of the city of Buffalo from the decision of the New York Supreme Court upholding an order of the New York Public Service Corporation increasing the rate of street-car fare to be charged by the International Railway Company. No federal question was found to be involved. The city sought to appeal on the ground that the constitutional inhibition against violation of contracts had been encroached upon.

Overhead Charges in Valuation for Rate Making.—In adjudicating a suit brought against the Public Service Commission of West Virginia by the Natural Gas Company of West Virginia to obtain a suspension of an order fixing rates, the Supreme Court of Appeals of that state said: "In determining the reproduction cost new of a utility property, generally expenses for organization, engineering, legal services and superintendence, interest and taxes during construction, and contingencies, are not reflected in estimates of the cost of labor, land and materials, and a reasonable allowance is made therefor under the designation of 'overhead charges'; but such charges as have been paid by the public as operating expenses should not be included as a part of the rate base. Nor, in the absence of proof of the actual expenditures therefor, should a lump sum or percentage allowance be made upon mere estimate, without a proper analysis of the different items included in the estimate, and without evidence tending to show that the expenditures so estimated were reasonably necessary to plant construction." (121 S. E. 716.)

Arizona Statute Creating Electrical Districts for Irrigation Held Constitutional.—Brown vs. Electrical District No. 2, Pinal County, was a suit brought in an effort to upset the Arizona law on which contracts with the Salt River Water Users' Association for hydroelectricity to be used for pumping are based. The Supreme Court of Arizona upheld the statute, holding that it does not authorize taxation for private purposes, does not fail properly to limit the power of directors or to provide due notice of hearings, does not exceed legislative powers by giving the districts power to impose assessment, does not violate the constitutional uniformity rule and is legal in other respects where attack was made. Nor did a contract with the state and a city whereby they were to be furnished power upon contributing a portion of the cost of the transmission line and other equipment, and the turning over of the physical possession of a transmission line during the life of the contract to an association from which the power was to be obtained, exceed the powers properly conferred. (233 Pac. 1068.)

Affirmation of Police Power of State.—In Borough of White Haven vs. Public Service Commission, the Supreme Court of Pennsylvania sustained the commission in its substitution of other rates for those in the White Haven Water Company's charter, saying: "The question is one of rate for service of a public service corporation. Charters are granted to such corporations subject to the reserved power of the commonwealth to supervise and regulate the exercise of their franchise, and included in this supervision and regulation is the rate to be charged for service. This supervision and regulation is brought into action in exercise of the police power of the commonwealth — a power which cannot be abridged or restricted by contract. The public service company legislation was intended to establish a complete system for the regulation throughout the commonwealth of rates to be charged by such companies. As such legislation is clearly within the capacity of the state, all special laws and contracts inconsistent with the exercise of this authority are repealed or abrogated thereby. That the limitation of the price to be charged by the water company for service to families was a regulation of rates is evident, and that subject is committed to the Public Service Commission." (123 At. 772.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

How to Make a House Organ Live

A Bit of Practical Advice on Conducting an Employee Publication from the Chairman of the Plant Publication Section of the National Safety Council

By S. W. Ashe
Director of Educational and Welfare Department, Pittsfield Works, General Electric Company

THE title of this brief article might seem to indicate that a formula was being offered by which an employees' house organ could live indefinitely. One would be playing too much into the hands of fate to offer such advice, but having published a paper for ten years and carried it through the ups and downs of business and labor troubles, the following suggestions based on this experience are offered:

The main difficulty with many employee publications and which is largely responsible for their high mortality in times of business depression is their lack of a definite editorial policy. If it is not possible to formulate such a policy, the publication has no justification for existence. What do we mean by a definite policy? One in which we establish certain definite constructive functions for the paper, the results of which will justify the required expenditures of time and money. Let us mention some of these for a manufacturing organization. A bank or a department store might have other definite aims.

Safety.—Many shop papers were started as part of live accident prevention campaigns. When posters, talks and conferences no longer arouse the initial enthusiasm, a house organ can still continue to maintain interest owing to the diversity of personal ways in which the material can be presented. I know of one specific instance in which the publication of material on ruptures was alone responsible for almost the entire elimination of this type of accidents. Reports of inspections, of employees' service committees, the results of contests, cartoons, interesting notes about accident prevention, and notes about first-aid crews, about the doctors, nurses and emergency hospital sustain interest. People like to see their names in print, and where they are taking an active part in accident prevention work the shop paper offers an excellent medium for maintaining their enthusiasm.

Thrift.—Where companies offer stock-and-bond-purchase plans for employees on a basis of weekly deductions from the pay envelope, a shop paper offers an opportunity for urging the advantages of purchasing securities month after month. Authorities on thrift can be quoted; tabulations showing the rate at which savings accumulate and articles showing how to make budgets and how to purchase can be printed. As thrift is largely a habit and as habits are principally formed through systematic effort, the printing of thrift material at regular intervals will do much to form this habit. In fact, the importance of printing this material systematically lies in the old law of Newton that "a constant force produces acceleration."

Suggestion Systems.—Where a suggestion system is in vogue the awards each month, with photographs and brief biographies of the prize winners, should be published. Inspirational articles on the importance of suggestion systems might also be used. Where an employee is promoted as a result of particular interest in the suggestion systems, the fact should be recorded in the paper.

Process Stories.—Articles which describe the manufacturing operations carried on in specific departments, the process being described and illustrated in an educational manner for the benefit of every one in the plant as well as of those on the outside mailing list, should be used at frequent intervals; for instance, one a month is worth while. Cuts used with such articles are useful later when booklets or magazine advertising is prepared. Employees in the particular departments written up like to take these articles home, besides which they are useful to commercial departments for use by their representatives in showing to customers the care taken in the manufacturing operations.

Insurance and Mutual Benefit Activities.—Statements showing receipts and expenditures for various insurance activities such as group insurance and mutual benefit associations should be published in the house organ. Such a practice creates confidence on the part of other workers. When an affair like a carnival is given to raise funds full details of all reports and expenditures should be published. Photographs of officers, committees, carnival decorations, field days, using as many names as possible underneath the photographs, should be used in addition to the financial statements. Photographs of checks given in special circumstances are sometimes used, such as an insurance check received when an employee has only been eligible for a short time. Where employees practice thrift by subscribing to companies' savings plans and are properly insured, the problem of administering relief takes care of itself automatically. Employees must be taught to protect their families in addition to such protection as the company offers in the way of pension systems and group insurance plans. House organs can be used month after month in promulgating this information.

Progress, New Developments, Plant Extensions.—All new developments, departmental appointments, plant extensions, important orders received, new buildings, new committees appointed and letters of commendation received by the management should be included regu-

larly, the idea being to have the plant publication at the end of the year include in the bound volume a complete record of the progress of the company during the year. If this progress is recorded systematically, the management in times of depression will hesitate to break the continuity of the record. The number of pages and available appropriations may be reduced, but the paper stands a good chance of not being discontinued.

Biographies.—Biographies of important people in the organization, department heads, engineers, those who are making distinctive contributions in the way of ideas, long-service or quarter-century men, should be worked up, using fairly large photographs. Many employees have made unusual contributions and have given extraordinary service to the company. It is much better to write about these persons while they are alive than to wait till they are dead. These biographies help weld an organization together and keep strengthening it. In addition they attract unusual attention. When some old employee is pensioned or when some ten-year man dies, irrespective of his position in the company, a photograph and "write-up" should be made of him. This should be done as a matter of course. We have a custom in Pittsfield of placing our flag at half mast on the main administration building for every ten-year man who dies. Each such commemoration is followed with a story in the works paper.

News and "Personals."—Every shop paper depends largely on news, personal items and photographs to sustain interest. In fact, the average editor would rather sacrifice most of his paper than give up his "personals." On the other hand, some papers come to a natural death by the improper use of such matter. Where a high percentage of employees are girls there is a greater tendency to use personals. One should bear in mind, however, that while these personals evoke a temporary interest and serve to lighten the paper, it is the serious material that makes a paper live. Some editors choose the safe policy of using personals only when there is something definitely constructive to record. On the other hand, other editors go to such extremes that they manage to get the name of every employee in the paper at least once and sometimes twice a year. There is nothing which can be abused so much or lead to greater trials and tribulations than the use of personals, without due care and thought.

Relationship of Copy. — Added strength can be given a particular issue of a works paper by sounding a definite keynote. As an illustration, a center-page "double spread" may contain many of the photographs which illustrate the leading article. One of these may be unusually distinctive and have so much action in it that it is suitable for a cover design. Then, again, there may be some departmental gathering or a meeting of specialists whose photographs will give a particular personal touch to the department being described. There may be an unusual safety record or a production record of this particular department which will fit admirably in the particular issue.

Costs.—A good round figure to use in computing costs is about one dollar per employee per year. This compares favorably with $9 per employee per year for group insurance, $6 for accident compensation and about $4 for miscellaneous educational and welfare work.

What Is Ahead in Radio

Probable Extension of Broadcasting in the Educational Field—What the Jobber Should Do

BY S. D. MCCARTHY
President McCarthy Brothers & Ford, Buffalo, N. Y.

THE question of the future possibilities in the radio field from the standpoint of the electrical jobber and retailer is an interesting one. We have watched this branch of our business grow from nothing to a point where it represents today a large percentage of our supply sales, and all within approximately three years. We have studied the question deeply and are firmly convinced that thus far the manufacturers and dealers have only scratched the surface so far as developing the sale of radio equipment is concerned.

One of the big fields for radio in the future, I believe, will be on the educational side. This will be a most logical development. Why should an instructor in school or college give of his talents and abilities to a class limited by the four walls of the classroom when through the radio he can reach thousands? We now know that it is very practicable to teach foreign languages and many other subjects by radio, and we can look for a very rapid development in this direction in the years ahead. The languages, history, English, certain of the sciences—in fact, anything that does not require the use of diagrams and the laboratory—can be taught over the radio. The question of who is to pay for such educational instruction by radio is yet to be solved, but that, I believe, will work itself out because of the need for such a service.

TREND OF BROADCASTING

Another important coming development is the dissemination of news of extraordinary moment, the addresses of great men on vital public questions and similar utterances. President Coolidge has demonstrated what can be done in this direction, and without doubt the coming presidential campaign will open the eyes of every one to the possibilities ahead. As more adequate facilities for broadcasting such addresses are worked out through linking up the great broadcasting stations of the country this phase of the business will open up another vast market for radio supplies, and the more the manufacturer, the wholesaler and the retailer can aid in this development the more business each will receive. The use of radio in clubs and organization rooms is now becoming very general, and I believe that within the very near future theaters all over the country will begin installing sets. At the same time the installation of radio in all kinds of public halls will receive a big impetus.

In my opinion, the broadcasting of "jazz" music and similar programs is merely a passing phase of radio. It is an intermediary step between the crude attempts at broadcasting in the earliest days and the broader, more valuable applications of the art ahead of us. Of course, music will probably always play its part in the radio program, but as radio develops to its larger possibilities the entertainment feature will become minor instead of major.

It was its entertainment features that gained for radio its first rapid introduction throughout the entire country, but it will be these other features as they are brought out that will make the use of the art all but universal. The broadcasting of busi-

ness information will be developed much further in the future, but in this there is a danger to be avoided. Radio should not be used for advertising. Every time the advertising phase is permitted to creep in the cause is hurt. It is perfectly legitimate to put on the radio any business information that is for the good of all, but when the business information has for its principal object the advertising of a private industry its value to the listener-in is undoubtedly limited.

WHAT THE JOBBER SHOULD DO

In all this development of the future of radio, which promises to make it a business whose magnitude we can only surmise at the present, the wholesaler has a very important part to play. One thing that he can do and should do is to advertise radio for the benefit of his dealers. We practice what we preach. McCarthy Brothers & Ford were among the pioneers who established radio broadcasting stations in the early days of the business. As the establishment of large and powerful stations became more general the time came when we felt that it was no longer essential for us to maintain our own, but the point I wish to make is that the jobber can be a leader in initiating movements that will tend to build up radio business for his dealers and thereby promote his own interests. Newspaper advertising, radio displays and the distribution of radio literature by mail are other forms of useful jobber advertising which should be indulged in.

Personally I feel that one of the biggest promotion functions of the jobber today is in making arrangements which will enable his dealers to sell radio sets and equipment on the partial-payment plan. The big distribution of radio sets among the public will undoubtedly come as a result of satisfactory partial-payment plans, just as in the sale of talking machines, vacuum cleaners and the like. In our own retail department we have featured a hundred-dollar set that is sold for $20 down and $10 a month, and our results have been satisfactory enough to indicate that such plans will give the radio eventually a distribution surpassing anything thus far accomplished.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE electrical market this week continues in good volume with steady prices. There is increased evidence of a growing recognition that current business should not be literally compared with the boom figures for the corresponding period of 1923, and that sales to date actually show a very satisfactory total. One of the largest contracts for steel-mill electrification ever placed was reported this week by a prominent manufacturer. Another announced the letting of a contract for a considerable increase in factory facilities. A large engineering firm states that it has now under design and construction over 500,000 hp. in generating plants. These are all elements in the situation which bear out the very noticeable confidence that exists throughout the industry, even though general business has been slowing down.

New England trade is holding up well, with line materials probably the best seller. Range business has been exceedingly strong, but small appliance sales have tapered off. Buying continues from hand to mouth in New York with the total volume fair. Fan stocks are reported as being in good shape. The steel and iron industry has been buying electrical materials actively in the Southeast, and large appliance business has been good, although general retail sales are quiet. The tone of the market was considerably better in the Middle West and many orders were placed during the week. It is announced that on the Pacific Coast the cattle epidemic is under control and retail sales in the country districts have reacted immediately. Power sales to industry show an increase and contractors are selling more actively to the industrial market. Construction material and motors are moving well.

Keen Competition in Pumping Industry—Deliveries Good

MANUFACTURERS of pumps report that the present demand is somewhat below normal. Competition is very severe, and the volume of business available to-day is not sufficient to fill all the shops manufacturing this line of equipment. Since the latter part of 1923 up to the present time conditions in the industry have been generally quiet. However, certain things indicate that the year will be a normal one, and activity in the pump business is definitely looked forward to later in the year. The increasing use of centrifugal pumps will contribute to better sales.

Deliveries are excellent as manufacturers have ample shop capacity to produce equipment that may be required under certain conditions and have no difficulty in obtaining materials. In fact, deliveries are better than the buyer should logically demand in the case of such machinery as pumping equipment. The variation in demand makes it necessary to build to order a large portion of the pumps sold, and this causes a certain delay which could be materially cut down if the present attempts to standardize the product more nearly are successfully carried out. Many of the smaller centrifugal pumps are manufactured on a quantity basis so that shipment of this type can usually be made within the same week that the order is received at the factory. On the average, nearly all equipment can be furnished within three or four weeks after receipt of the order. Prices at the present time are fairly constant, and it appears as though the market will be steady for some time to come. It is interesting to note that manufacturers are showing less of a tendency to go after business at any cost.

Turbines in Fair Demand—Prices Staple

THE demand for turbines for driving generating equipment, which for the past year has been so good as to cause manufacturers to work to capacity on this class of equipment, has been showing a falling off in line with the normal trend, according to manufacturers. Sales of small turbines for auxiliary drive in large central stations have slackened off owing to the policy of driving the auxiliaries electrically and bleeding steam from the main turbines for feed-water heating. However, a fair amount of business is still being obtained from the public utilities as only the very large stations have adopted the policy of using almost complete electrical drive for auxiliaries. Considerable interest shown by industrial engineers in turbine-driven generator units, as well as the growing tendency to use turbine-driven pumps, blowers, etc., where reciprocating machines were formerly used, has created a good demand for this class of turbines and has helped to fill the gap. In the textile and paper industries also, where use can always be found for clean process steam, good sales of small turbines are reported.

Deliveries in general are considered good and vary from thirty days to four months for turbines up to 3,000 kw. capacity, with six months quoted by some manufacturers. The time required for delivery of corresponding machines has practically not changed to any extent over a long period of years, the reason being that while increased efficiency in production would normally have enabled machines to be built more rapidly, there have been so many refinements and special features for improving operation incorporated in existing units that these added features virtually offset any time which could be saved through modern manufacturing methods. There is still a productive capacity greater than the demand, taking the situation as a whole, for there yet exists much wartime capacity to be taken up.

There is no particular indication of a change in prices from what they have been for some time past, and at present they appear to be staple. Smaller turbines have for more than a year sold on a close margin of profit. With

larger turbines it is, of course, impossible to establish fixed prices because of the variation in each piece of apparatus, but at the present time the figures can safely be said to be approximately half way between those of 1900 and 1914, during which period prices showed a steady and substantial decrease.

Dull Week in Metal Market—Copper and Tin Slightly Weaker

THE last week in the metal market has been dull. However, there has been a tendency for lead and zinc to advance slightly, although copper and tin are somewhat weaker.

The price of copper continues weak, even though a careful estimate places production for the month of March at 121,000 tons while consumption is placed at 150,000 tons. Consumption thus exceeds production by 29,000 tons, or 24 per cent. The market has been forced down as low as 13 cents, but most producers are unwilling to meet this price. Copper, however, can easily be had at 13¼ cents, and at least half a million pounds were sold as low as 13.10 cents.

NEW YORK METAL MARKET PRICES

	May 7, 1924 Cents per Pound	May 14, 1924 Cents per Pound
Copper, electrolytic	13¼—13⅜	13—13⅛
Lead, Am. S. & R. price	7.50	7.50
Antimony	8¼	8¼
Nickel, ingot	27	27
Zinc, spot	6.10	6.22½
Tin, straits	47	46
Aluminum, 98 to 99 per cent	28—29	28½

Lead could be obtained all last week for less than 7.50 cents, the official contract price, but early this week a strengthening was apparent due to better news from abroad. The market is being watched closely by consumers who fear than an upward reaction may find them short of lead for early use. Zinc has advanced slightly in price owing to the present prices of ore. Most sales have been for June and July delivery and at a five-point premium. Tin was in good demand last Thursday and Friday, but since then purchases have not been heavy. Most of the present orders are for rush shipments.

New England Trade Continues Steady

SALES of electrical material continue in good volume in the New England district, the more active commodities being line material, fiber conduit and the heavier appliances for household use. A Boston jobber reported Tuesday that his business this month exceeds his volume of a year ago as well as those earlier this spring. The demand is spotty, but it is remarkably well distributed. Electric ranges are moving faster all through New England. Last week the Boston Edison Company sold thirty ranges, and Tuesday twenty-four were bought for a single apartment house in that territory. The demand for smaller appliances seems to be falling off in many cases, but electric appliance sales as a whole are running 40 per cent ahead of last year for one large New England utility group. Utility expansion is absorbing large quantities of fiber conduit, and steps are being taken to improve deliveries here.

Industrial conditions are uneven, with textiles badly depressed. Some improvement can be seen in the metal-working industries and central-station power sales are better in some quarters. Industrial electric ovens are selling well. Prices are steady in most lines. Lamp stocks are accumulating in the factories, one house reporting a five months' supply on hand compared with a normal stock of three months' sales.

Sales Slow but in Fair Volume in New York District

THERE has been no change in the slowing down of business in the New York district this week. The hesitancy in buying is evident, but the total volume of business is fair. Central-station buying is still the steadying influence in the market. Practically no motor stocks are in the hands of the dealers, while the manufacturers of apparatus such as pumps, blowers, etc., are following the policy of buying from hand to mouth. This situation is assisted by the fact that stocks are readily available and transportation conditions are very good.

Jobbers report that the slowing down of business with them is uniform. Sales are normally distributed and there is no particular drop in any one line. More fan business is reported as being on the books of jobbers than ever before. The policy of conservative buying is also being closely followed by the jobbers themselves so that there is no accumulation of stocks.

Business Holding Up Well in Southeast District

WHILE retail sales are not all that could be desired, business is holding up in a reasonably satisfactory way in the Southeast. The inquiries from large industrial firms which were received a few weeks back have not yet been followed by orders, and their purchases are only for necessities. Here and there developments are under way, but the general conditions are spotty. The steel and iron industry in the Birmingham district continues very active, and some very satisfactory sales of electric welding apparatus are reported for the past ten days. These sales are probably the entering wedge for well-sustained purchases along this line.

The storage-battery interests report considerable activity in the central-station class of apparatus, with mine-locomotive and terminal-tractor business in excellent shape. Starting and lighting batteries, which began the year with a boom, have failed to respond to the usual seasonal activity and are reported somewhat slow. Appliance sales continue to be satisfactory, with one of the large jobbers reporting his sales for the first quarter of 1924 20 per cent in excess of the same period a year ago. Kitchen-lighting equipment sales are brisk, several of the large central-station companies having campaigns under way. One town of nine thousand residential customers placed one thousand units the first week of the campaign.

Tone of Market in Middle West Is Considerably Improved

BUSINESS this week in the Middle West was on a more satisfying and enlarged scale. More orders were placed and the tone of the market was considerably better. Central-station construction continues a prime factor, and purchases for maintenance help to improve the general market conditions. The principal items for which substantial orders were placed this week were meters, both the switchboard and apartment type, and wire. There was a reduction by one manufacturer of from 1 per cent to 12 per cent in the price of three-phase squirrel-cage motors. This followed a price reduction last month of about 5 per cent on single-phase motors. The price of outlet boxes was also reduced 1 per cent by all manufacturers; otherwise, the market was free from price fluctuations.

Considerable interest is being aroused in better lighting equipment for homes, stores and offices throughout central and southern Illinois. Active campaigns are being conducted by the various utilities serving these districts. Sales of this equipment in and around the close proximity of Chicago have been very good this week. Jobbers state that they have been requested to quote on a greater quantity and variety of merchandise, and the situation looks considerably better from their standpoint.

Good Business on Pacific Coast—Cattle Epidemic Dying Out

BUSINESS on the Pacific Coast is holding up very well despite a certain amount of pessimism. Building permits for April, 1924, have shown a slight decrease over the same month of last year, but with the cattle epidemic apparently under control and transportation conditions accordingly improved, an encouraging note is struck which will react on the future buying of the country districts affected.

Sales of electric power to industrials in the San Francisco district show a 35 per cent increase over last year, and it is noted that electrical contractors are soliciting industrial business with renewed keenness. Such lines as poles, cross-arms, pole-line hardware and tools show, for the first time in a considerable period, a uniformly even rate of shipment. For instance, a recent order for an Arizona irrigation project totaling about twenty-five carloads of poles, two carloads of cross-arms and one carload of pole-line hardware is being promised for immediate shipment.

Motor sales are excellent with 5-hp. sizes in prominent demand. Rubber-covered wire prices have again declined. Dealers' business is better in the country districts, where jobbers report a number of well-assorted stock orders, indicative of cautious buying which will produce better general conditions. Sales of household appliances are steadily improving. Prices are rather unsteady, with if anything a downward tendency.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Receives Contract for Steel-Mill Equipment

The General Electric Company has just received a very large contract for electrical apparatus for use in the Aliquippa works of the Jones & Laughlin Steel Corporation, Woodlawn, Pa. The apparatus will be used to equip a 14-in. continuous steel mill.

The contract calls for ten direct-current, adjustable-speed 600-volt motors, ranging in size from 200 hp. to 3,000 hp., five motor generators with an aggregate capacity of 13,500 kw., a number of mill-type motors for mill tables and cranes with complete voltage drop controls, several large switchboards and two 500-hp. induction-type pump motors.

Link-Belt Awarded Gondola Car Dumper Contract

The Link-Belt Company, Chicago, has been awarded a contract for a gondola car dumper by the Columbus (Ohio) Railway, Power & Light Company. This dumper is almost identical with the one erected for the Cahokia station of the Union Electric Light & Power Company of St. Louis. The specification for the dumper calls for a mechanism that will capably handle 4,000 tons of coal in an eight-hour day and which will accommodate gondola cars of 120-ton capacity. The dumper is to be used at a new station being erected at Lockbourne, Ohio.

Stone & Webster Building Over 500,000 Hp. in Plants

In view of the many reports that business has reached the down-hill side of the curve it is noteworthy that this condition is not reflected by some of the large construction companies, which point to a very satisfactory volume of business on hand. As an illustration, Stone & Webster, Inc., Boston, have at present under design and construction more than 500,000 hp. in steam and hydro-electric plants scattered all the way from Boston to Seattle and from Columbus, Ga., to Los Angeles, Cal.

The steam plants include an initial installation of 60,000-kw. rating at Weymouth, Mass., for the Edison Electric Illuminating Company of Boston (ultimate capacity 300,000 kw.); the station of the Montaup Electric Company at Fall River, Mass.; an enlargement of a plant of the Indiana Electric Corporation near Terre Haute to 60,000 kw. before the original 40,000-kw. station has been placed in operation, and a stand-by station at St. Paul. On the Pacific Coast the company is installing 92,000 kw. for the Southern California Edison Company to keep pace with its rapidly expanding hydro-electric program. Included in the other water-power plants are undertakings which range from the modernization of small stations and placing them under automatic control to such developments as those for the Columbus (Ga.) Power Company at Bartlett's Ferry on the Chattahoochee River and for the Puget Sound Power & Light Company on the Baker River, in Washington.

Hi-Voltage Equipment Company Awarded 132,000-Volt Contracts

The Hi-Voltage Equipment Company, Cleveland, has been awarded contracts for the switching equipment of the 132,000-volt and 66,000-volt substations designed by Stevens & Wood, New York, according to L. C. Hart, president. These substations will be installed at the Toronto power house of the Ohio River Edison Company and at Youngstown, and will be used for distributing energy in their respective districts and also to furnish a tie-in with the other 132,000-volt transmission lines in Ohio. The contract includes a large number of motor-operated air-break switches and also some 45-deg. balanced disconnecting switches.

Additions to Westinghouse Plant at Homewood

Approximately 120,000 sq.ft. of floor space will be added to the Homewood plant of the Westinghouse Electric & Manufacturing Company upon the completion of three new factory units now under construction. The new units, which will be of modern concrete construction, will be combined in a four-story-and-basement building, with a two-story materials building adjoining, and will be devoted entirely to the manufacture of renewal parts and coils for electrical apparatus. In this the new buildings will supplement existing plant area, bringing the total floor space devoted to this work to 200,000 sq.ft.

The additional units will be ready for occupancy about November 1 and will give employment to about one thousand men. The buildings with their equipment will cost about $700,000.

Allis-Chalmers Obtains Contract for Cushman Power Project

The Allis-Chalmers Manufacturing Company has obtained a contract for furnishing and installing the machinery equipment of the first unit of the Cushman power project from the Tacoma (Wash.) City Light Department. The contract price was $630,780 for the turbines, generators, condensers, transformers and minor equipment and $4,950 for installation. The time limits set for the delivery of the machinery are so favorable that the completion of the power house is expected at least one month before the schedule figured.

Wagner Electric Sells Fynn-Weichsel Installation in Ohio

The Wagner Electric Corporation, St. Louis, has sold an installation of eight Fynn-Weichsel motors, totaling 120 hp., for use at the Herbrand Company's new plant at Fremont, Ohio. The Herbrand Company has also purchased twenty-eight Wagner squirrel-cage induction motors ranging from 1 hp. to 30 hp. and totaling 121½ hp.

This new motor was chosen for use with induction motors as the solution to a power-factor question because of the favorable power-factor clause in the contract of the Ohio Power Company, which furnishes the Herbrand Company with power. The entire plant will be put in operation this month, and it is expected that by using the Fynn-Weichsel motor an average power factor of 97 per cent will be maintained.

The Ideal Commutator Dresser Company, 5321 Northwestern Avenue, Chicago, is manufacturing a solderless and tapeless wire connector which is waterproof and not easily broken. A steel wire spring embedded in the body of the connector cuts into the spliced wire enough to make a perfect contact. The connector screws on like a nut, binding the twisted end of the wires together to make contact and overlaps the insulation of the wire. These connectors are known as "Jasper wire joint caps" and are approved by the Underwriters' Laboratories.

The Allen-Bradley Company, Milwaukee, has recently placed on the market a complete new line of resistance starters and across-the-line switches for induction motors. The type J-1552 is an across-the-line starting switch, the type H-1852 is a semi-automatic resistance starter, and the type J-3052 is an automatic resistance starter. Both of the resistance starters are equipped with the Allen-Bradley graphite compression resistors.

The H. S. B. W. Cochrane Corporation, Philadelphia, announces that it has dropped the initials from its name and will hereafter be known as the Cochrane Corporation.

The T. A. B. Electric Company, Trenton, N. J., has acquired property at 443 South Broad Street, consisting of two three-story brick buildings on a site 60 ft. x 110 ft., for a consideration said to be $20,000. The new owner will take immediate possession and will make extensions and improvements in the structures. About one-half of the space will be occupied by the company for expansion; the remainder will be leased.

C. M. Nevius, Inc., 178 Main Street, Hornell, N. Y., has developed an electric coffee cutter for individual service in homes, restaurants and small institutions and will shortly place it on the market.

The American Insulating Machinery Company, Fairhill and Huntingdon Streets, Philadelphia, manufacturer of wire-drawing machinery, insulating machinery, etc., has brought out a four-light signal of the overhead trolley type for electric railways which is said to be a decided improvement over the former type.

The Hygrade Lamp Company, Salem, Mass., is offering a new mill-type reflector lamp in 25 watt and 50 watt sizes, 110 to 125 volts, and 50 watt sizes, 220 to 250 volts. The lamp has an enameled reflector coating, extending from the base about two-thirds the length of the bulb, which acts as an efficient reflector, giving nearly 70 per cent more useful downward light on the working plane than a clear mill-type lamp of the same wattage and over 100 per cent more useful light than an ordinary vacuum lamp when both are used without shades.

The Rothacker Film Manufacturing Company, 1339 Diversey Parkway, Chicago, is distributing a two-reel motion picture of the story of "Bakelite" to dealers, schools, etc., who wish to give it local showing under their auspices. No rental charge is made.

The Westinghouse Electric & Manufacturing Company announces that it has acquired an interest in the R. M. Laird Electric Company, Minneapolis. Mr. Laird will supervise the activities of distributing agencies in the Twin Cities territory.

The Buffalo Forge Company, Buffalo, manufacturer of heating and ventilating fans, blowers, etc., will open a new Western office at Seattle, Wash., on June 1. The states of Oregon, Idaho, Montana and Washington as well as the territory of Alaska will be covered from this office. The products of the two companies associated with the Buffalo Forge Company—namely, the George L. Squier Manufacturing Company and the Buffalo Steam Pump Company—for this territory will also be handled from the new office. Arthur Forsyth will be in charge.

The General Electric Company recently shipped two 20-ton storage battery locomotives to the Montgomery Gravel Company, for use at its Arrowhead, Alabama, plant, recently electrified. Each locomotive is equipped with two 60-hp., 250-volt motors and a 100-cell Exide Ironclad battery. They will be used for hauling sand and gravel from the pit.

M. J. Daley & Company, electrical installations, announce that since May 1 the New York office has been at 25 West Forty-third Street.

The Corliss Carbon Company, Bradford, Pa., announces that C. F. Cole has been appointed representative in the St. Louis territory. The Beckett Electric Company, Inc., of Dallas, Oklahoma City and New Orleans has been appointed exclusive distributor for Corliss brushes in the Southern States. Sales for the month of April are reported as being 22 per cent higher than any previous month in the company's history, which is said to represent an increase in sales both for automobile starting and lighting outfits and for other classes of apparatus.

The Western Electric Company is offering a complete new line of seven Davis floodlighting projectors. While there are but seven different types, the range covered is sufficient to meet practically all requirements in the floodlighting field. The Davis line includes a new searchlight, beamlights and floodlights, and there is a smaller, lighter-weight unit for general utility purposes.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Radiation Pyrometer

A pyrometer of the radiation type, sold under the trade name "Pyro," for measuring temperatures between 500 deg. C. and 2,000 deg. C., has been placed on the market by the Bowen Instrument Company, 9 Newton Road, Leeds, England. It is easily portable, weighs only 25 oz., is 7 in. long by 4⅜ in. in diameter and is self-contained.

A lens made of a special glass having low absorptive properties for heat rays focuses the image of the hot body on to a blackened absorbing disk to which the hot junction of a small thermocouple is soldered, the whole being inclosed in an evacuated glass bulb. The two leads from the thermocouple are connected to a sensitive millivoltmeter. The instrument is provided with a double scale, a diaphragm being placed over the objective to cut off a certain definite proportion of the radiant heat when the higher scale is used. An eyepiece in front of the instrument enables the observer to locate it correctly with respect to the furnace. The distance from the furnace opening to the instrument must not exceed twenty-four times the diameter of the opening, which should not be less than 1½ in. to 2 in.

Relay for Reclosing Equipment

A new type of relay, designed for application to existing systems for automatically reclosing oil circuit breakers any predetermined number of times, has been placed on the market by the Western Electro-Mechanical Company, Oakland, Cal. The instrument consists essentially of a motor-driven timing disk which takes six minutes to make one revolution. Near the edge of the disk are twenty-four holes equally spaced which receive the contact pins. The time required for the disk to travel the distance between two of these contacts is fifteen seconds, so that the reclosing of the oil switch can be accomplished at fifteen-second intervals or any multiple thereof up to six minutes. One of these holes is made into a slot for the lockout, and by the moving of a stop pin on the disk to its proper position the relay can be made to lock out after any predetermined number of closing operations and, in addition, to ring an alarm bell. The disk is reset for operation by pressing a button on the relay case.

Oil Engine

A heavy-duty, high-efficiency oil engine known as the type R has been developed by the Foos Gas Engine Company, Springfield, Ohio. This engine is of the vertical single and multiple-cylinder, four-cycle type, operating at high compression and using automatic injection. The question of simplicity and accessibility received very careful attention in this design, so that the four-cycle cam shaft, valves, levers, injectors and every detail requiring operating attention are conveniently at hand from the platform. All crank shafts and connecting rod bearings are easily accessible through large hinged doors on both front and rear of the base.

The fuel system has had careful attention, with the result that the fuel is injected directly into the combustion space with no pressure on the fuel system except during the injection—about one-hundredth of a second. This is said to give more accurate and precise operation, saves leakage, maintenance cost, pumping up pressure before starting, etc., and also simplifies construction and operation. By the application of a single "measuring" pump which supplies the fuel to each injector in turn exactly the same amount of fuel is fed into each cylinder and the load between cylinders is kept accurately balanced.

Portable Arc Welder

A new portable arc welder designed to insure smooth and rapid deposition of metal with thorough penetration has been developed by the General Electric Company. It will deliver continuous power and permit rapid production both with high current and large electrodes and with low current and small electrodes.

The welder is a two-unit motor-generator set with the generator self-excited. Values of current between 75 amp. and 300 amp. can be obtained in a large number of steps by turning a handwheel on the generator. A self-adjusting stabilizing reactor is provided, which automatically steadies the arc under all welding conditions. The set can be used with any of the commercial sizes of metallic electrodes from ⅛ in. to ¼ in. in diameter. The voltage of the generator can be adjusted to suit the character of the work. The set is provided with roller-bearing wheels, holes in base for crane hooks, special motor and generator insulation and waste-packed bearings. It is also adaptable to long or short leads for working close by or at a distance from the set. The assembled unit is about 63 in. long, 29 in. wide and 47 in. high, and weighs about 1,600 lb.

Cooling Fan.—A fan for use in steel mills, foundries, forges and other plants where heat-treating processes are employed has been brought out by the American Blower Company, Detroit. The fan, known as the "man-cooling fan," resembles a giant-size desk type. It is built in two sizes having wheels 21¼ in. and 37¼ in. in diameter, operating at 1,725 r.p.m. and 1,120 r.p.m., and requiring 1-hp. and 4-hp. motors respectively.

New Trade Literature

SAFETY SWITCH.—The Square D Company, Detroit, is distributing a folder calling attention to the "Square D" safety switch.

STEAM PURIFIER.—"Why Is Steam Impure?" is the title of bulletin No. 26 issued by the Andrews-Bradshaw Company, 530 Fourth Avenue, Pittsburgh, Pa. It tells the reasons of impure steam and shows how the use of the "Tracy" steam purifier makes possible the delivery to turbines and engines of clean dry steam at all times.

INSTRUMENTS FOR RADIO CONTROL PANELS.—The Roller-Smith Company, 233 Broadway, New York City, has issued bulletin No. 10, covering its small-size instruments for radio control panels, types "TID," "TA" and "TAW" (all 3½-in. diameter).

METERS AND GAGES.—Bulletin No. 9 issued by the Bailey Meter Company, 2,015 East Forty-sixth Street, Cleveland, Ohio, describes and illustrates the "Bailey" flush-front meters and gages.

REFLECTOR LAMP.—The Hygrade Lamp Company, Salem, Mass., is distributing a folder covering the "Hygrade" reflector lamp, mill type, "the lamp that carries its own reflector."

MECHANICAL PAINTING EQUIPMENT.—Bulletin No. 120 issued by the W. N. Matthews Corporation, St. Louis, describes and illustrates the "Matthews" mechanical painting equipment for industrial and maintenance painting. The mechanical painting equipment is used for painting, enameling and japanning automobiles, metalware, machinery and practically all types of manufactured articles as well as buildings.

MOTOR STARTERS AND CONTROLLERS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued bulletin No. 59, in which is listed a complete line of its direct-current motor-control apparatus so arranged that the user can readily find the listing of the apparatus needed.

EXTERIOR LIGHTING UNITS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a publication, known as No. C1,674, entitled "Ornamental Brackets, Newels and Lanterns." It is designed primarily for use of architects in drawing plans for ornamental exterior lighting. It gives illustrations of a number of exterior lighting units for use in the illumination of entrances and façades of public buildings, bridges, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Melbourne, Australia (No. 10,153), for electrical goods.

Purchase and agency is desired in Weltevreden, Java (No. 10,162), for electrical goods, especially wiring supplies and line devices.

An agency is desired in Vienna, Austria (No. 10,160), for radio broadcasting apparatus for small stations.

An agency is desired in Amsterdam, Netherlands (No. 10,158), for radio parts and supplies.

Purchase is desired in Nueva Gerona, Cuba (No. 10,161), for telephone instruments, coin boxes and dry batteries.

Purchase is desired in Campbellton, Canada (No. 10,189), for electrically operated ice-making machinery.

An agency is desired in Vienna, Austria (No. 10,173), for copper and tin, electrolytic, 20,000 kilos to 25,000 kilos of each yearly.

An agency is desired in Vienna, Austria (No. 10,163), for specialty goods and patented articles for use in the electrical trade.

An agency is desired in Melbourne, Australia (No. 10,153), for surgical and dental goods, including electromedical and electrodental appliances.

PROPOSED NEW POWER PLANT IN INDIA.—A concern which operates a jute mill and engineering works in India, each with its own organization and power plant, contemplates the erection of a central power station for both plants, using high-pressure steam turbo-generator sets. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its district offices by referring to No. 16,623.

TENDERS FOR ELECTRICAL EQUIPMENT FOR ELECTRIC PLANT IN SOUTH AFRICA.—Tenders will be taken by the Kingwilliamstown (South Africa) Municipality until July 8 for electrical and steam raising plant, high-tension cables, etc.

TRANSFORMERS FOR WAIKATO (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until July 15 for twelve substation transformers for the Waikato power scheme (section 78).

New Incorporations

THE TAYLORSVILLE (IND.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 to generate and distribute electricity in German Township and surrounding territory. The incorporators are Alonzo O. Smock, Genton Foster, Frank B. Richards, George Royse and John Sablette, all of Taylorsville.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BILLERICA, MASS.—Extensions to the street-lighting system are under consideration. The plans call for forty new lamps. The Lowell (Mass.) Electric Light Corporation furnishes the street-lighting service.

LOWELL, MASS.—Improvements contemplated by the Lowell Electric Light Corporation during the year include the construction of two bus feeders, to cost about $13,500; erection of substation in the residential section, $25,000, and extension of duct line from station to center of the city, $7,500. John A. Hunnewall is manager.

NORTH ABINSTON, MASS.—The Electric Light & Power Company of Abington and Rockland contemplates the installation of a new swichboard at the Cohasset substation. Frank N. Sanderson is manager.

SALEM, MASS.—Preliminary work has started on the construction of the power plant of the Salem Terminal Company, operated by the Charles H. Tenney Company, 200 Devonshire Street, Boston.

HARTFORD, CONN.—The Connecticut Company has filed plans for the erection of a two-story addition to its power house on Commerce Street.

Middle Atlantic States

BEACON, N. Y.—The Southern Dutchess Gas & Electric Company plans to erect a three-phase, 13,300-volt transmission line (a total of 8 miles) to make interconnect with the Wappingers Falls Electric Corporation. W. E. Conklin is president and general manager.

BEAVER FALLS, N. Y.—Plans have been prepared by the Beaver River Power Corporation for a hydro-electric development here, consisting of a 50-ft. dam, 600-ft. penstock, power house, etc., to cost about $85,000.

COLLIERS, N. Y. (P. O. Colliersville)—The New York State Gas & Electric Company contemplates the construction of a local substation, to cost about $200,000.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has applied to the Public Service Commision for permission to construct and operate an electric distribution system in the towns of Brookfield, Cherry Valley, Westford, Maryland, New Berlin and Pine Plains, where it has already been granted franchises.

JAMESTOWN, N. Y.—Plans are being prepared for the installation of an ornamental lighting system on Roosevelt Square, to cost about $20,000.

KENMORE, N. Y.—The Board of Village Trustees is considering the installation of an ornamental lighting system, to cost from $30,000 to $35,000.

LOCKPORT, N. Y.—The Niagara, Lockport & Ontario Power Company has sold an issue of $3,000,000 in capital stock, part of the fund to be used for extensions to its system.

MALONE, N. Y.—Extensions and improvements contemplated by the Malone Light & Power Company, this year include the installation of a new switchboard at the Malone switching station, a new substation at Brushton and rebuilding several lines. F. J. Elder is treasurer.

NEW YORK, N. Y.—Bids will be received by W. C. Bower, agent, room 344, 466 Lexington Avenue, New York City, until May 23, for incandescent lamps required by the following companies for one year to be covered by serial contract No. 12-1924: New York Central Railroad Company, Boston & Albany Railroad, Grand Central Terminal, Troy Union Railroad, New York & Harlem Railroad, New York State Railways, Rochester Gas & Electric Corporation, Cleveland, Cincinnati, Chicago & St. Louis Railway, Indiana Harbor Belt Railroad Company, Schenectady Railway Company, Union Passenger Depot Association, Cleveland; Rutland Railroad Company, Michigan Central Railroad Company, Pittsburgh & Lake Erie Railroad Company, Monongahela Railway, Trunk Line Association, Cincinnati Northern Railroad, Peoria & Eastern Railway and Chicago River & Indiana Railroad Company.

ROME, N. Y.—The Northern New York Utilities, Inc., Watertown, contemplates building a 10,000-hp. steam generating plant here, to cost about $250,000.

ST. GEORGE, N. Y.—Extensions and improvements contemplated this year by the Staten Island Edison Corporation include the erection of 10 miles of 33,000-volt transmission line and two 5,000-kva. substations. C. W. Gillespie is assistant to vice-president.

SCHENECTADY, N. Y.—Plans have been prepared by the Adirondack Power & Light Company for the erection of a 110,000-volt transmission line from Oneida to Syracuse (30 miles), to cost about $250,000.

TUPPER LAKE, N. Y.—The installation of an ornamental lighting system, consisting of fifty to sixty standards, mounted with cluster lamps, to cost about $30,000, is under consideration by the Village Board.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates building a new 30,000-kw. steam plant this year.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates the erection of a three-phase, high-tension transmision line from Trenton to Newport, to cost about $25,000.

WARSAW, N. Y.—The New York Central Electric Corporation has started work on the extension of its transmission lines from Warsaw to Wyoming. Arrangements have been made to use the poles of the Rochester Telephone Corporation. The corporation has been requested to extend its lines to Hermitage and Lamont.

WATERLOO, N. Y.—A movement has been started to light the main highways in Seneca County. Herman F. Brehm, Waterloo, is interested in the project.

WATERTOWN, N. Y.—Bids are being taken, it is reported, by the Power Corporation of New York for a hydro-electric development on Beaver River at Soft Maple Dam, including dam, penstock, power house, generating equipment, etc., to cost about $500,000.

ATLANTIC CITY, N. J.—The Atlantic City Electric Company has been authorized to take over and consolidate the Cape May County Electric Company, the Cape May Light & Power Company and the West Jersey Electric Company. Plans are under way for extensions in the transmission lines of the purchasing company.

KEANSBURG, N. J.—Bids will be received by the Borough Council at the office of the Borough Clerk until May 27 for improvements to waterworks pumping station and filters, including pumping station, two electrically driven centrifugal pumps, four service pumps, three 420-gal. pressure filters and equipment, two 110-kw. generators and Diesel engines and one wash-water tank. Alexander Potter, 50 Church Street, New York City, is consulting engineer.

HARRISBURG, PA.—Improvements and extensions contemplated by the Harrisburg Light & Power Company during 1924 include the installation of a 1,200-hp. boiler, one 8,000-kw., 22,000-volt substation and

the erection of 5 miles of two-circuit, 22,000-volt transmission line. H. Root Palmer is vice-president and general manager.

HUMMELSTOWN, PA.—The Hummelstown Water & Power Company contemplates the erection of 6 miles of 13,200-volt transmission line during this year. H. Root Palmer is vice-president and general manager.

JUNIATA, PA.—The Penn Central Light & Power Company, Altoona, plans to erect a substation at Hutchinson's Curve. The company has begun work on the erection of a transmission line from Roxbury to a point 6½ miles to the south, where it will connect with the lines of the Potomac-Edison Company.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company is arranging for the sale of bonds for $1,000,000, of which more than $500,000 will be used for extensions and improvements, including a new one-story substation at Fox Chase, $90,000; installation of rotary converter and auxiliary equipment at the Ranstead substation, $50,000; shop facilities and equipment, lines and signal apparatus for the Market Street Elevated Railway, $100,000, and emergency electric and utility equipment and housing, $81,000.

PITTSBURGH, PA.—The Chief of Engineers, United States Army, Washington, D. C., will have plans drawn for the construction of two hydro-electric power plants on the Ohio River, at Locks 7 and 8 respectively. Bids will be asked in the near future by the district engineer at Pittsburgh.

ST. CLAIR, PA.—The Philadelphia & Reading Railroad Company, Reading Terminal, Philadelphia, has tentative plans for the electrification of its line from Frankville to St. Clair, to cost about $1,500,000.

SILVER BROOK, PA. — The Pennsylvania Power & Light Company has closed contracts for service at the local mines of the Candlemas Coal Company, and will extend its transmission line from McAdoo.

HAVRE DE GRACE, MD.—The Common Council has preliminary plans under advisement for the construction of a municipal electric power plant, for which an appropriation of $300,000, was approved by the recent state Legislature.

BRISTOL, VA.—The Edmondson Power & Electric Company is considering the construction of a hydro-electric plant on the Holston River, to cost about $250,000. A transmission line will be built.

DANVILLE, VA.—The Board of Public Works is considering plans for an ornamental lighting system on Craighead Street and will call for bids at an early date.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 27, for a number of electric drills and grinders, for Eastern and Western yards (Schedule 2152).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until May 20 for switchboard, set tools, four sets circuits and assembly drawings, two testing units and cable rack (Circular CP 17540-2); also, at the same time, for 500 transformers and 181 mounting hangers (Circular CP 17663-1).

North Central States

CARO, MICH.—Plans are being prepared by Ayers, Lewis, Norris & May, Cornwall Building, Ann Arbor, for the construction of a hydro-electric plant in Caro for the Great Lakes Power Company.

CHELSEA, MICH.—The Electric Light & Waterworks Commission will install additional equipment at the municipal electric light plant.

DETROIT, MICH. — The Fisher Body Company, General Motors Building, has filed plans for the construction of a power house at its plant at Piquette and Hastings Streets, to cost about $75,000.

DETROIT, MICH. — Plans are being prepared by the Detroit Edison Company for the construction of a concrete dam and power house to develop 1,000 kw. wasteways, etc.

MACKINAC ISLAND, MICH. — The Municipal Water, Light & Power Company contemplates the installation of an additional oil-engine-driven unit and electrically operated pump and a switchboard voltage regulator this year. Frank B. Doherty is manager.

BALLAIRE, OHIO.—The Board of Trustees, Belmont County Home, has authorized the construction of a power house at the institution. George W. Neweey, Zanesville, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until May 23 for panel glass for "white way" lanterns for the division of light and power.

PADUCAH, KY.—The Paducah Electric Company contemplates the erection of new distribution lines, the purchase of transformers and meters during 1924, to cost about $27,000. Fred Cloen is superintendent.

COLFAX, IND.—The Northern Indiana Power Company has withdrawn its recent petition to the Public Service Commission for permission to purchase the Colfax Electric Company.

GREENSBURG, IND. — Improvements contemplated by the Greensburg Gas & Electric Company include the erection of new and additional leads into plant, larger feed wires to distribution transformers, new and increased protection from lightning at plant and overhead distribution system. William W. Woodfill is secretary and treasurer.

MACKSVILLE, IND.—The Indiana Electric Corporation is reported to be planning for the construction of a local generating plant, to cost about $225,000. Stone & Webster, Inc., 147 Milk Street, Boston, Mass., are engineers. Macksville has not a post office.

HAMPSHIRE, ILL.—The Illinois Northern Utilities Company plans extensions and betterments in the local street-lighting system, changing from a multiple to a series system. A ten-year lighting contract has been secured.

CUBA CITY, WIS.—Improvements are contemplated to the municipal electric plant and distribution system, to cost about $11,000.

GREEN BAY, WIS.—Plans are under way by the Wisconsin Public Service Corporation to extend its transmission line from Collins to Brillion, a distance of 10 miles, which will form a 66,000-volt new loop between the Manitowoc and Green Bay plants. The present 15,000-volt, 25-cycle line from Brillion to Wrightstown will be changed to 60 cycles, 66,000 volts, and will connect with the new 66,000-volt Green Bay-Oshkosh line at Wrightstown.

MADISON, WIS.—The City Council is considering installing ornamental lamps (seventeen units) in South Madison, recently annexed to the city; also extension to the street-lighting service in other parts of the city, especially in the outskirts.

MILWAUKEE, WIS.—Plans have been prepared by the city illumination bureau for extensions to the municipal street-lighting system in the territory between Fifty-fifth, Sixtieth and Chestnut Streets and Washington Boulevard and on the Lake Drive from Waterworks Park to Lake Park. Street lamps will also be installed in Fernwood, recently annexed territory, south of Oklahoma Avenue. Howard Ilgner is superintendent of bureau.

RHINELANDER, WIS. — The Rhinelander Light & Power Company plans to build a steam generating plant to be used for standby service.

WAUWATOSA, WIS.—The City Council is considering installing a new street-lighting system in the business district.

WILMAR, MINN.—Bids will be received by the City Council for a new municipal electric light and power plant.

JOPLIN, MO.—The Joplin Empire District Electric Company is reported to be planning to erect a transmission line to Springfield and surrounding towns.

MONETT, MO. — The Council contemplates extensions and improvements in the municipal power station, including the installation of new equipment.

ST. JOSEPH, MO.—The City Council is said to have authorized a fund of $50,000 for extensions in the municipal electric power plant, to include the installation of boilers, engine and generator, etc.

GRAND FORKS, N. D. — The State Board of Administration, Bismarck, plans to install new equipment in the electric plant at the University of North Dakota, including generator, engine, etc., for which bids are expected to be called at an early date.

GRAND FORKS, N. D.—The City Council has retained Arthur Mullergren, consulting engineer, Gates Building, Kansas City, to prepare plans for a municipal light and power plant for municipal requirements and the street-railway system, for which $110,000 in bonds has been voted for the initial development. The cost of the project for serving the entire commercial and municipal requirement is estimated at about $500,000.

HASTINGS, NEB. — A special election will be held on May 27 to vote on the proposal to issue bonds for proposed extensions and improvements to the municipal electric power plant.

Southern States

BETHEL, N. C.—The Town Council is disposing of a bond issue of $25,000, the proceeds to be used for extensions and improvements to the light and power system.

CANTON, N. C.—Following the acquisition of the Canton Electric Company by new interests, tentative plans are under consideration for the construction of a hydro-electric power plant on the Pigeon River, near Canton, and a number of extensions in transmission lines.

WAKE FOREST, N. C.—The Board of Trustees, Wake Forest College, has authorized plans prepared for a power house at the institution to cost about $75,000.

CLINTON, S. C. — The Lydia Cotton Mills, Inc., has authorized plans for the complete electrification of its plant and will install a substation, motors, controls, lighting system, etc. Lockwood, Greene & Company, Atlanta, Ga., are engineers.

VALDOSTA, GA.—The Valdosta Lighting Company contemplates extensions and improvements in its plant and system. A preferred stock issue of $255,000 is being arranged, a portion of the proceeds to be used for expansion.

TAMPA, FLA.—The United States Export Chemical Company plans to construct a power house at its proposed local phosphate works, to cost about $250,000. Peter S. Gilchrist, head of the Chemical Construction Company, Charlotte, N. C., is engineer for the project.

GALLATIN, TENN.—The City Council is considering the installation of an ornamental lighting system around the public square and business section of the city.

JASPER, ALA. — The Bankhead Coal Company is reported to be planning for the installation of electric power and other equipment at its properties, including tipple, with capacity of about 2,000 tons of coal per day.

COLUMBIA, MISS.—Bids, it is understood, will soon be asked for improvements to the municipal electric plant and waterworks, including one 1,500-kw. generating unit, new electric and feeder lines, 400-hp. boiler, steam-turbine centrifugal pump, reservoir, etc., to cost about $190,000.

BERWICK, LA.—Preliminary plans are being prepared for a municipal electric light plant and waterworks system, to cost about $50,000.

BREAUX BRIDGE, LA.—Collins Conrad, Lafayette, and associates plan to construct an electric light and power plant for local commercial service.

HAYNESVILLE, LA. — Bids, it is reported, are being asked for the installation of an ornamental lighting system. A. H. Southern is chairman of committee.

GROVE, OKLA.—Surveys are being made by the Public Service Company, Tulsa, for a hydro-electric plant on the Grand River, near Grove, where it has acquired a site. The cost is estimated at about $1,000,000. The Byllesby Engineering Company, 208 South La Salle Street, Chicago, is engineer.

McALESTER, OKLA. — The Southwest Power Company, a consolidation of the Coal District Power Company, Huntington, Ark., and the Choctaw Power & Light Company, McAlester, has been granted permission by the Arkansas Railroad Commission to issue $2,000,000 in bonds, the proceeds to be used for the erection of a 66,000-volt transmission line from Wilburton, Okla., to Hartford, Ark., to connect with the Oklahoma properties.

WELEETKA, OKLA. — The Oklahoma Power Company, Okmulgee, plans to erect a 33,000-volt transmission line from Weleetka to Wetumka, to cost about $30,000.

AUSTIN, TEX.—The Water and Light Department plans extensions and improvements in the municipal electric system.

DALLAS, TEX.—Plans are under consideration to install ornamental lamps on portions of Earvay and Youngs Streets, to cost from $80,000 to $100,000. E. A. Kingsley is city engineer.

TERRELL, TEX.—Extensions are contemplated to the municipal electric power plant to double the present capacity.

WESTBROOK, TEX.—The West Texas Electric Company is said to be planning to build a local substation for service for the oil fields in this section. Work has begun on a transmission line from Colorado to Westbrook, about 10 miles.

Pacific and Mountain States

KELSO, WASH.—The North Coast Power Company has applied to the County Commissioners for permission to construct and operate transmission lines to supply electricity in additions to the city of Kelso and upon all the highways, roads and streets in Cowlitz County, except those that are located within incorporated cities or towns.

LONGVIEW, WASH.—The Pacific Straw Board & Paper Company plans to build a power house at its proposed local mill, to cost about $400,000.

MOUNT VERNON, WASH.—Application has been filed by Allen R. Moore, Mount Vernon, with the State Supervisor of Hydraulics for water rights on Pressentin, O'Toole and Cumberland Creeks, all tributaries of the Skagit River. The plans call for development of 3,750 hp. at a cost of $145,000.

OLYMPIA, WASH.—The Olympia Light & Power Company plans to install a three-phase, 2,300-volt, 350,000-circ.mil feeder from power house (12,000 ft.) to load center. A. G. Betts is superintendent.

SHELTON, WASH.—Plans, it is reported, are being prepared for the construction of a 5,000-hp. electric power plant to furnish power to operate the two large sawmills to be erected in Shelton by the McCleary Timber Company and the Reed Mill Company.

SPOKANE, WASH.—The American Fire Brick Company is said to be considering the installation of electric power equipment in connection with extensions and betterments in its plant to cost about $25,000.

TACOMA, WASH.—The City Council has authorized the installation of improved street-lighting systems on portions of the following streets: Steele Street, North First Street, Division Street, Tacoma Avenue, Ainsworth Avenue and South G Street.

FRESNO, CAL.—The City Council is considering the installation of an ornamental lighting system on Platte Avenue. William Stranahan is city engineer.

LOS ANGELES, CAL.—A resolution has been adopted by the City Council providing for the installation of a lighting system along Main and Sixth Streets, covering a distance of about 5 miles. The Marbelite type standard, mounted with a large single globe, will be used.

MERCED, CAL.—The Merced Irrigation District will take bids about June 1 for the construction of a hydro-electric plant in the vicinity of Exchequer, to cost about $500,000. R. V. Meikle is chief engineer.

SAN DIEGO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 4 (Specification 4,955) for the following work at the Naval Operating Base Hospital, San Diego. Part 1—Buildings, plain and reinforced work, etc. Part 2—Plumbing work, etc. Part 3—Heating and steam distributing systems, incinerator plant with hot-water heating, cleaning and sterilizing equipment; also lighting system for each building; power system, nurses' call system and telephone conduits in certain buildings, and an extension to the outside electrical distributing system.

SAN FRANCISCO, CAL.—The Feather River Power Company has been granted permission to use water from Gold Lake, Sierra and Placer Counties, for hydro-electric development; also from Bucks Creek, Plumas County, for similar purposes.

MESA, ARIZ.—The Independent Cotton & Oil Company, El Paso, plans to build a power plant at its proposed local cotton-oil mill, to cost about $700,000.

TWIN FALLS, IDAHO.—The Idaho Power Company has been granted a preliminary permit by the Federal Power Commission to construct a hydro-electric plant on the Snake River, near here, with initial output of 10,000 hp.

Canada

VICTORIA, B. C.—Contract for construction of power house of the University of British Columbia has been awarded by the government to Smith Brothers & Wilson, and that for the Essondale Mental Hospital to McDougal & McNeill. Tenders for mechanical equipment for the two power houses have not yet been acted upon by the department.

PRINCE ALBERT, SASK.—The date for receiving tenders for one 1,500-kw. steam-turbine generator and condenser for the municipal electric plant has been extended from May 15 to May 29.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 22, 1924)

1,491,147. ELECTRIC HEATER AND SADIRON; J. Lavoie, Montreal, Quebec, Canada. App. filed June 7, 1922.

1,491,151. ELECTRIC SWITCH MECHANISM; W. Lindsay, Chicago, Ill. App. filed Jan. 3, 1922. Rotary reciprocating actuation.

1,491,154. LINE SWITCH AND CONNECTIONS; F. A. Lundquist, Chicago, Ill. App. filed Oct. 23, 1918. In automatic telephone exchanges.

1,491,170. VARIABLE ELECTRIC RESISTANCE; K. Rottgardt, Dahlem, near Berlin, Germany. App. filed Dec. 5, 1921. Microphonic repeater.

1,491,177. TELEPHONE-EXCHANGE SYSTEM; R. L. Stokely, Floral Park, N. Y. App. filed March 4, 1920. For use where one exchange is automatic and the other manually controlled.

1,491,194. ELECTRIC HEATING ELEMENT; J. P. Burger, Cleveland, Ohio. App. filed March 4, 1922. For discharging heated air in a horizontal direction.

1,491,208. ELECTRICAL SOUND-CONVERTING APPARATUS; C. W. Peterson, Seattle, Wash. App. filed Aug. 2, 1922. Applicable to "loud speakers" or telephone transmitter.

1,491,223. CLOCK-SYNCHRONIZING MECHANISM; T. S. Casner, Plainfield, N. J. App. filed Sept. 20, 1922. For correcting master or other clocks by Hertzian waves transmitted through space from a central station with a standard time-piece.

1,491,250. ELECTROLYTIC MANUFACTURE OF COLLOIDAL METALS; C. H. von Hoessle, Radebeul, near Dresden, Saxony, Germany. App. filed Aug. 31, 1921.

1,491,274. INSULATING LIME SEAL; R. B. Rathbun, Salt Lake City, Utah. App. filed June 28, 1920. High-potential wall bushings.

1,491,278. SAFETY-SWITCH MECHANISM; L. Siebert, San Francisco, Cal. App. filed Oct. 17, 1921.

1,491,288. RADIO SIGNALING APPARATUS; G. H. Clark, Washington, D. C. App. filed May 2, 1919. Wave changers for arc sets.

1,491,321. ELECTROMAGNET; A. R. Swoboda, Newark, N. J. App. filed Dec. 17, 1921. Spool-head construction adaptable for electromagnets having laminated cores which are rectangular in cross-section.

1,491,323. TELEPHONE-EXCHANGE SYSTEM; D. L. Temple, Floral Park, N. Y. App. filed April 5, 1921. Using machine-switching mechanism.

1,491,325. FITTING FOR ELECTRICAL CONDUITS, OUTLET BOXES AND THE LIKE; G. C. Thomas, Jr., Elizabeth, N. J. App. filed Aug. 19, 1922. To close the opening in a conduit, etc., after installation and before wires are pulled.

1,491,326. BATTERY COVER; W. H. Thorpe, Mount Vernon, N. Y. App. filed Oct. 30, 1922. Removable.

1,491,327. REGISTER-CONTROL TELEPHONE-EXCHANGE SYSTEM; T. Van Amstel, New York, N. Y. App. filed Nov. 21, 1919.

1,491,330. BATTERY; T. Appleby, Philadelphia, Pa. App. filed Feb. 23, 1924. All radio batteries combined in a single unit.

1,491,334. TELEPHONE SYSTEM; W. L. Casper, Brooklyn, N. Y. App. filed Sept. 22, 1920. Employing long transmission lines over which both telephonic and signaling currents may be transmitted.

1,491,337. COIN COLLECT SYSTEM FOR AUTOMATIC TELEPHONE EXCHANGE; R. D. Conway, Chatham, N. J. App. filed Aug. 11, 1920.

1,491,338, 1,491,339. PAY-STATION AUTOMATIC TELEPHONE SYSTEM; R. D. Conway, Chatham, N. J. App. filed Feb. 19, 1921.

1,491,340. SYSTEM FOR SIGNALING; A. M. Curtis, East Orange, N. J. App. filed Aug. 13, 1919. For telephones.

1,491,341. CONDENSER; A. J. Eaves, New York, N. Y. App. filed Aug. 14, 1918. Variable.

1,491,343. LOADING COIL; W. Fondiller, New York, N. Y. App. filed May 21, 1921. For duplex-circuit signaling line.

1,491,344. RELAY CONTROLLING SYSTEM; J. R. Fry, New York, N. Y. App. filed Aug. 24, 1921.

1,491,345. ELECTRICAL REGULATING DEVICE; J. O. Gargan, Brooklyn, N. Y. App. filed Dec. 7, 1921. Resistor capable of fine adjustment.

1,491,347. SPEEDOMETER; B. Goldman, New York, N. Y. App. filed Dec. 31, 1921. For indicating the speed of a vehicle by day or night.

1,491,348. TELEPHONE-EXCHANGE SYSTEM; L. Keller and C. L. Goodrum, New York, N. Y. App. filed Aug. 30, 1920. Machine-switching system comprising private branch exchange working.

1,491,349. ELECTRICAL RECEIVING OR REPEATING APPARATUS; B. W. Kendall, New York, N. Y. App. filed Feb. 20, 1917. For cable work.

1,491,350. ENCIPHERING AND DECIPHERING MECHANISM; F. R. McMurry, Westwood, N. J. App. filed Jan. 24, 1919. For telegraphic work.

1,491,351. AUTOMATIC-TELEPHONE SWITCH; J. L. McQuarrie, New York, N. Y. App. filed Dec. 15, 1920. As used in exchanges.

1,491,357. SECRET SIGNALING; H. W. Nichols, Maplewood, N. J. App. filed Dec. 13, 1920. Signals transmitted in the form of a complex wave which can be resolved into a series of waves having frequencies comprised within a given range.

1,491,358. ENCIPHERING AND DECIPHERING MECHANISM; H. Pfannenstiehl, East Orange, N. J. App. filed Dec. 28, 1918. For telegraphic work.

1,491,359. MEANS AND METHOD FOR REDUCING CROSS-TALK IN LOADING COILS; H. B. M. Pleijel and A. H. Olson, Stockholm, Sweden. App. filed May 5, 1921.

1,491,362. VACUUM TUBE; H. E. Shreeve, Millburn, N. J. App. filed Feb. 20, 1918. Using a new form of shell.

1,491,363. SADIRON; J. A. Spencer, Revere, Mass. App. filed June 29, 1922. With temperature automatically regulated.

1,491,372. RADIO RECEIVING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 28, 1921.

1,491,375. INDUCTION MOTOR; S. R. Bergman, Nahant, Mass. App. filed May 28, 1923. Having unequal slot spacing in rotor.

1,491,379. ELECTRODE HOLDER; J. Cera, Pittsfield, Mass. App. filed Feb. 28, 1923. For arc welding.

1,491,381. PROCESS FOR THE PRODUCTION OF GLOSSY METALLIC COATING ON METALS; A. Classen, Aachen, Germany. App. filed Oct. 21, 1922. Galvanic process.

1,491,385. INSULATOR; G. Faccioli, Pittsfiled, Mass. App. filed Nov. 8, 1918. Bushing type.

1,491,386. POLE SHADER; J. B. Ford, Schenectady, N. Y. App. filed June 22, 1921. With magnetic properties.

1,491,389. SOLDERING IRON; C. M. Frykman, Minneapolis, Minn. App. filed July 11, 1921.

1,491,391. SOCKET SHELL; S. S. Grady, Newtonville, Mass. App. filed June 14, 1923. For pull-chain socket.

1,491,396. STARTING AND PROTECTIVE SWITCH; C. I. Hall, Fort Wayne, Ind. App. filed May 2, 1921. Thermal-time type.

1,491,402. ELECTRICAL SYSTEM; H. S. Holbrook, Rugby, England. App. filed June 17, 1921. For protecting transformers against internal faults.

1,491,403. ELECTRIC TROLLEY CONTACT HEAD; F. D. Hough, Zion, and E. P. Shultis, Waukegan, Ill. App. filed Sept. 27, 1923. Sliding type.

1,491,405. SIGNAL-RECEIVING SYSTEM; A. W. Hull, Schenectady, N. Y. App. filed March 1, 1921. For continuous wave signals of radio frequency.

1,491,420. CONTROL SYSTEM; D. C. Prince, Schenectady, N. Y. App. filed Feb. 19, 1921. For connecting rotating apparatus to a source of current without causing undue disturbance.

1,491,421. BEAD-CLOSING MECHANISM FOR TIRE-WRAPPING MACHINES; G. W. Prouty, Boston, Mass. App. filed May 9, 1923.

1,491,439. AMPLIFYING SYSTEM; H. C. Thompson, Schenectady, N. Y. App. filed Feb. 26, 1921. Employing electron-discharge devices of the dynatron or negative resistance type.

1,491,440. SWITCHING APPARATUS; E. Thomson, Lynn, Mass. App. filed June 2, 1921. To obviate injury to a switch on opening a circuit due to the arc.

1,491,441. HIGH-SPEED ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; E. Thomson, Swampscott, Mass. App. filed Dec. 5, 1921. Capable of being used at higher speed than has heretofore been possible with commercial frequencies.

1,491,448. TROLLEY SHOE; J. L. Whittaker, Winthrop, Mass. App. filed Jan. 26, 1922. Sliding-contact type.

1,491,450. HIGH-FREQUENCY SIGNALING SYSTEM; W. C. White, Schenectady, N. Y. App. filed Feb. 4, 1920.

1,491,451. DOUBLE-SPEED SYNCHRONOUS DYNAMO-ELECTRIC MACHINE; R. W. Wiesemen, Schenectady, N. Y. App. filed Dec. 5, 1921. With two efficient operating speeds.